Run 14 RHIC Machine/Experiments Meeting

1 July 2014

Agenda:

- **Run 14 Schedule** (Pile)
- **Machine Status** (Robert-Demolaize)
- **STAR and PHENIX Status** (Experiments)
- **STAR - Proposal for special internal target run at injection**
- **Other**

Call in bridge line is 631-344-8383

Run 14 plan based on 22 weeks cryo operation

and Fischer et.al. RHIC Collider Projections (FY 2013 – FY 2017), 4 Jun 2013

- ✓ 3 Feb, Begin cool-down to 4.5K
- ✓ 4 Feb, Cool-down to 6K in Blue
- ✓ 7 Feb, Blue and Yellow at 4.5 deg K
- ✓ 10-Feb, Beam in Blue and Yellow at injection
- ✓ 15-Feb, Begin √s = 14.6 GeV/n AuAu physics
- ✓ 11 Mar (Tuesday, 0800), End √s = 14.6 GeV/n AuAu physics run begin setup for √s = 200 GeV/n AuAu
- ✓ 15-Mar (~14:00, store 18046), Begin √s = 200 GeV/n AuAu physics run
  - ✓ PHENIX 1st physics store = 18046 (15 March)
  - ✓ STAR 1st physics store = 18064 (17 March)
- ✓ 16-Jun (0700), end 13.3 week √s = 200 GeV/n AuAu run
- 16-June begin setup for √s = 200 GeV/n ^{3}HeAu run
- 20-June first Physics Store

- ***today, 1 July…***

- ~~7~~- 6-July (0700), end 2.3 week √s = 200 GeV/n ^{3}HeAu run, power supply regulator work
- ~~4~~-7-July, Test DX move then begin cryo warm-up
- ~~7~~- 10-July, warm-up complete, ~~22.0~~ 22.4 cryo weeks of operation

See http://www.rhichome.bnl.gov/AP/RHIC2014/ for the Run Coordinator's detailed plan

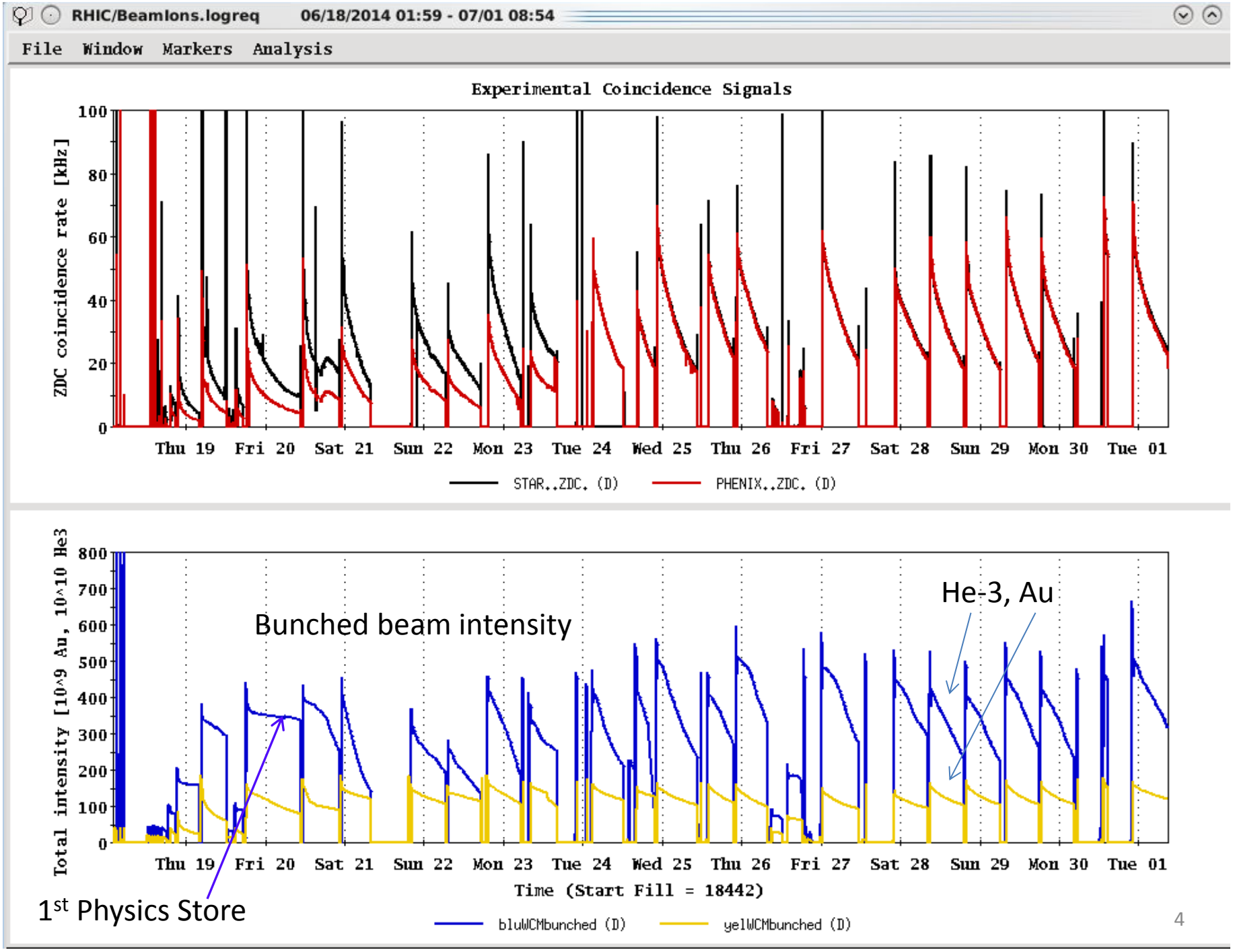
^{3}He-Au at 200 GeV/n

STAR Goals

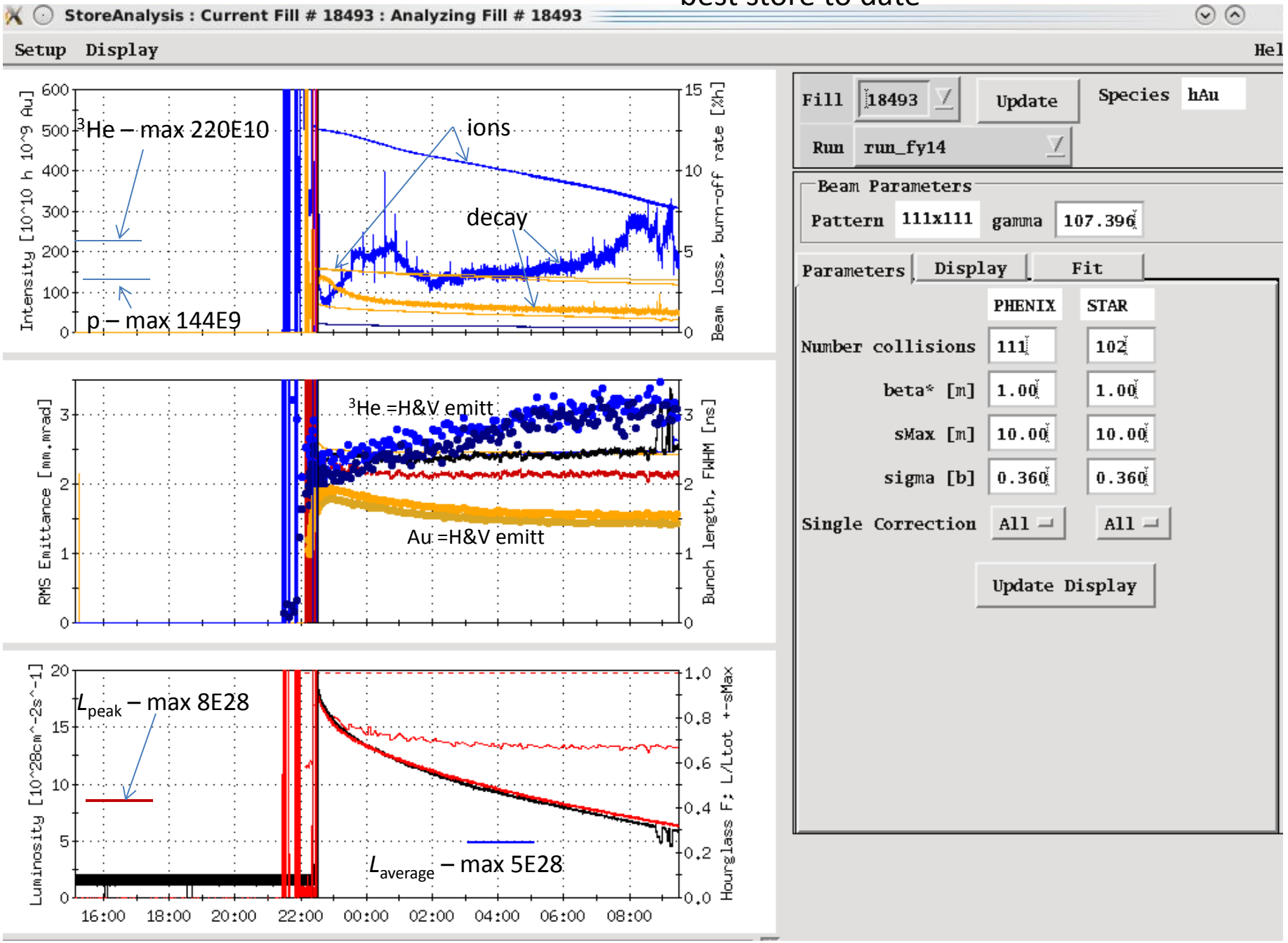
- Physics Goal: 150M in min-bias and central triggers

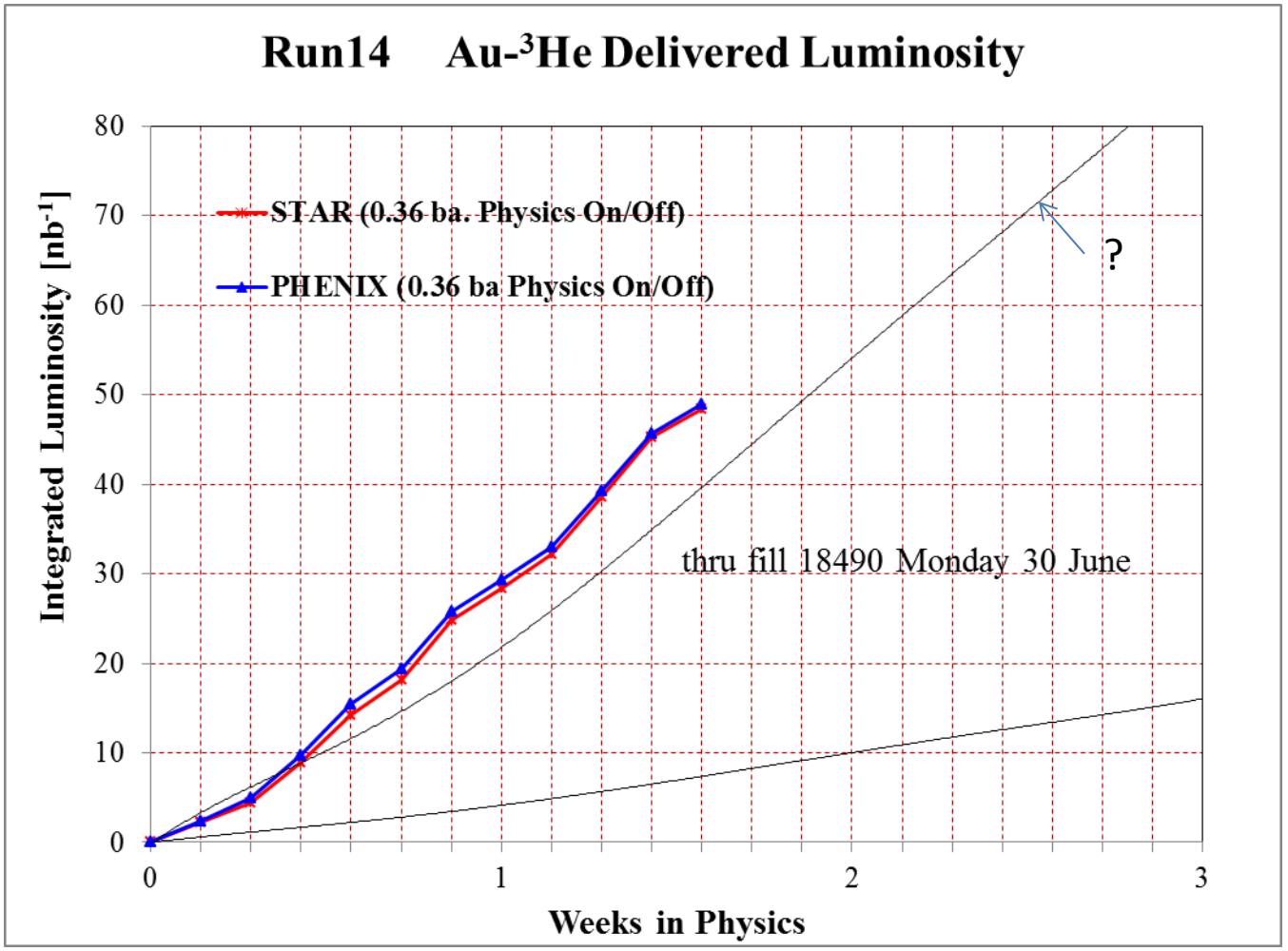
PHENIX Goals

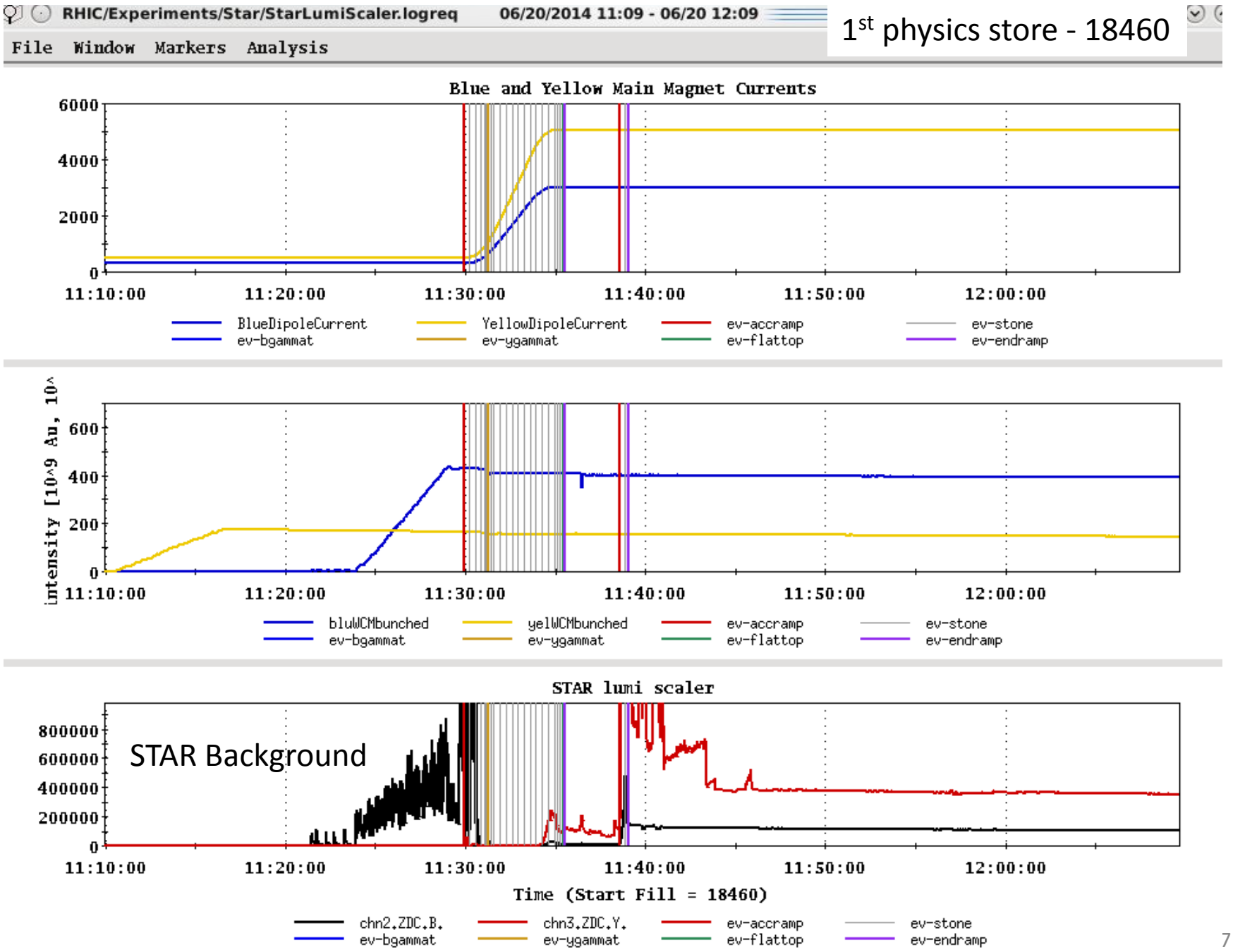
- 1.8 B events within +/- 10 cm


RHIC/BeamIons.logreq 06/18/2014 01:59 - 07/01 08:54
File Window Markers Analysis
Experimental Coincidence Signals
ZDC coincidence rate [kHz]
100
80
60
40
20
0
Thu 19 Fri 20 Sat 21 Sun 22 Mon 23 Tue 24 Wed 25 Thu 26 Fri 27 Sat 28 Sun 29 Mon 30 Tue 01
STAR..ZDC. (D)
PHENIX..ZDC. (D)
Total intensity [10^9 Au, 10^10 He3
800
700
600
500
400
300
200
100
0
Bunched beam intensity
He-3, Au
Thu 19 Fri 20 Sat 21 Sun 22 Mon 23 Tue 24 Wed 25 Thu 26 Fri 27 Sat 28 Sun 29 Mon 30 Tue 01
Time (Start Fill = 18442)
blueWCMbunched (D)
yelWCMbunched (D)
1st Physics Store

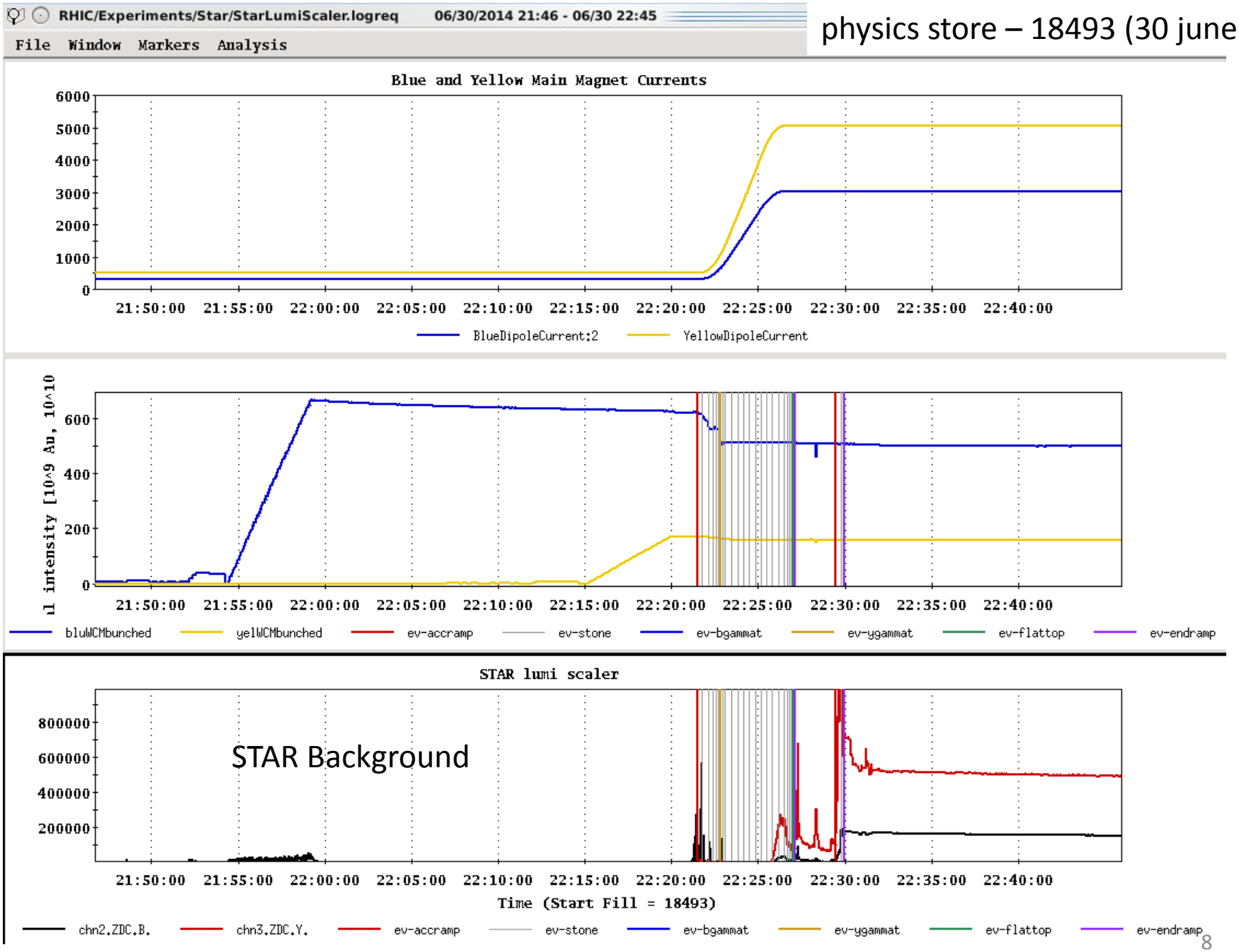
~ best store to date




Run14 Au-3He Delivered Luminosity
Integrated Luminosity [nb-1]
Weeks in Physics
STAR (0.36 ba. Physics On/Off)
PHENIX (0.36 ba Physics On/Off)
thru fill 18490 Monday 30 June
?
0
10
20
30
40
50
60
70
80
0
1
2
3


RHIC/Experiments/Star/StarLumiScaler.logreq
06/20/2014 11:09 - 06/20 12:09
File Window Markers Analysis
1st physics store - 18460
Blue and Yellow Main Magnet Currents
6000
4000
2000
0
11:10:00
11:20:00
11:30:00
11:40:00
11:50:00
12:00:00
BlueDipoleCurrent
ev-bgammat
YellowDipoleCurrent
ev-ygammat
ev-accramp
ev-flattop
ev-stone
ev-endramp
Intensity [10^9 Au, 10^
600
400
200
0
11:10:00
11:20:00
11:30:00
11:40:00
11:50:00
12:00:00
bluWCMbunched
ev-bgammat
yelWCMbunched
ev-ygammat
ev-accramp
ev-flattop
ev-stone
ev-endramp
STAR lumi scaler
STAR Background
800000
600000
400000
200000
0
11:10:00
11:20:00
11:30:00
11:40:00
11:50:00
12:00:00
Time (Start Fill = 18460)
chn2.ZDC.B.
ev-bgammat
chn3.ZDC.Y.
ev-ygammat
ev-accramp
ev-flattop
ev-stone
ev-endramp

physics store – 18493 (30 june)



STAR Request *(extracted from Time Meeting Presentation)*

Special runs and datasets before end of run:

- Beam mis-steering at STAR for lower luminosity. Two low luminosity stores will give us data that require minimal to no calibrations for faster analysis.

- 3 hours of Fixed Target tests.

- 3 hours of data taking for Heavy Flavor Tracker tests.

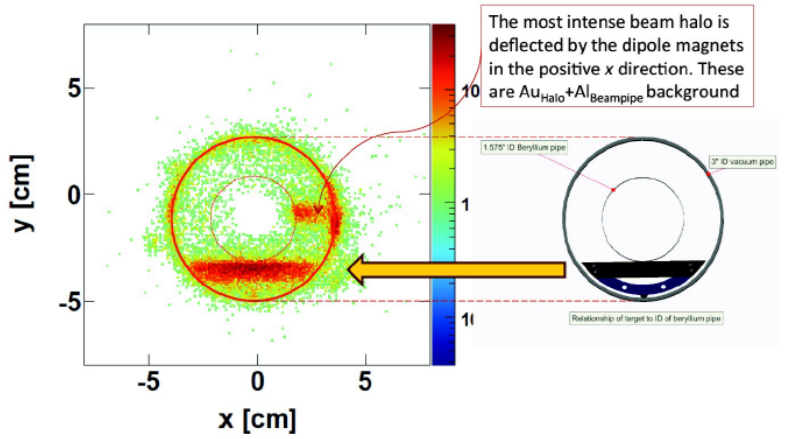
STAR Request

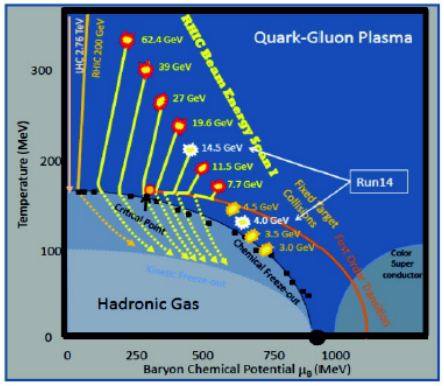
Fixed Target physics program:

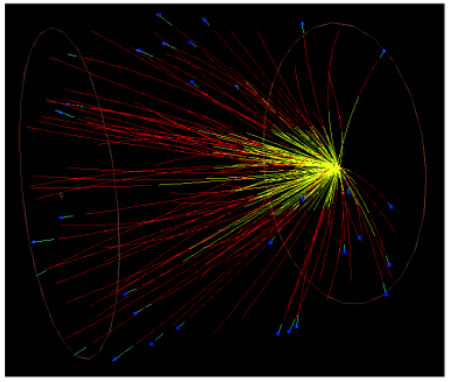
The key observables to study are:
- Pions and protons spectra.
- Directed flow (v_1).
- Elliptic flow (v_2).
- Two-pions HBT.

at center-of-mass energies of 3-4.5 GeV.

These observables will extend the BES physics down to lower energies. They are also to be compared with published results from AGS,E866/E917,E877 and E895 experiments.







STAR Request

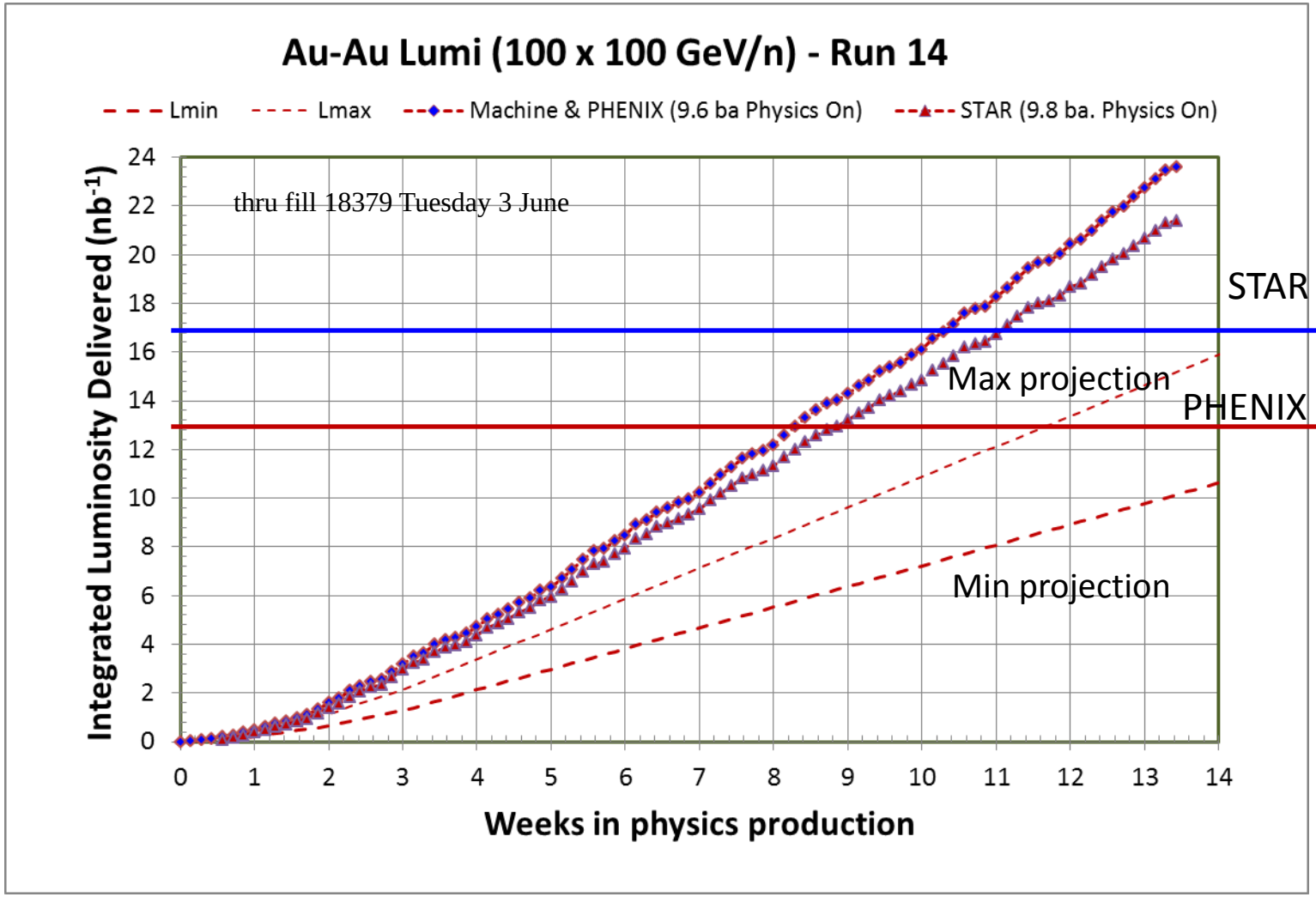
Fixed Target tests:

Request:

- Au in Yellow ring at injection energy (9.8GeV) and orbit (5mm vertical drop).

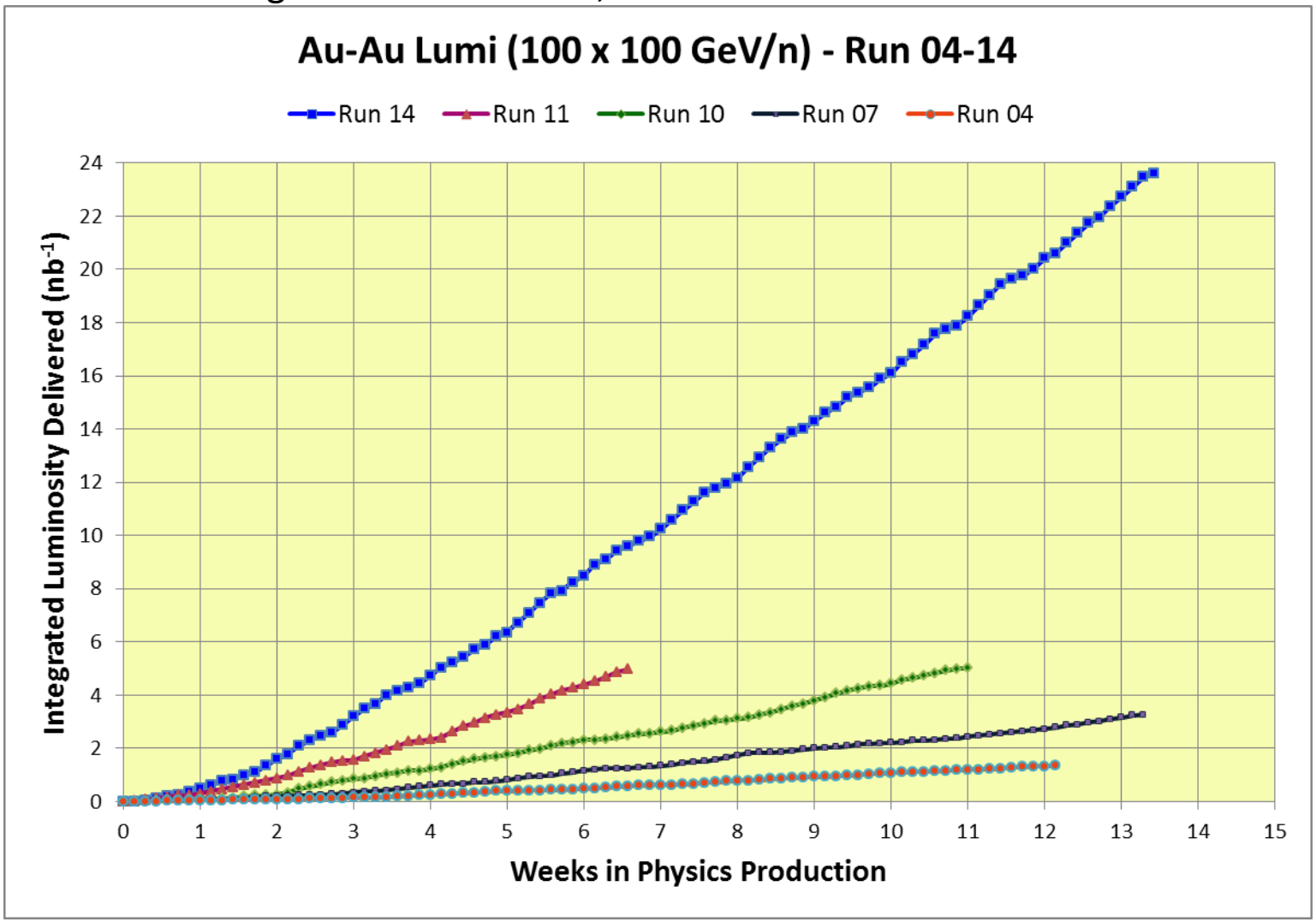
- The goal is to get 50k Au+Au fixed target events.

Archive

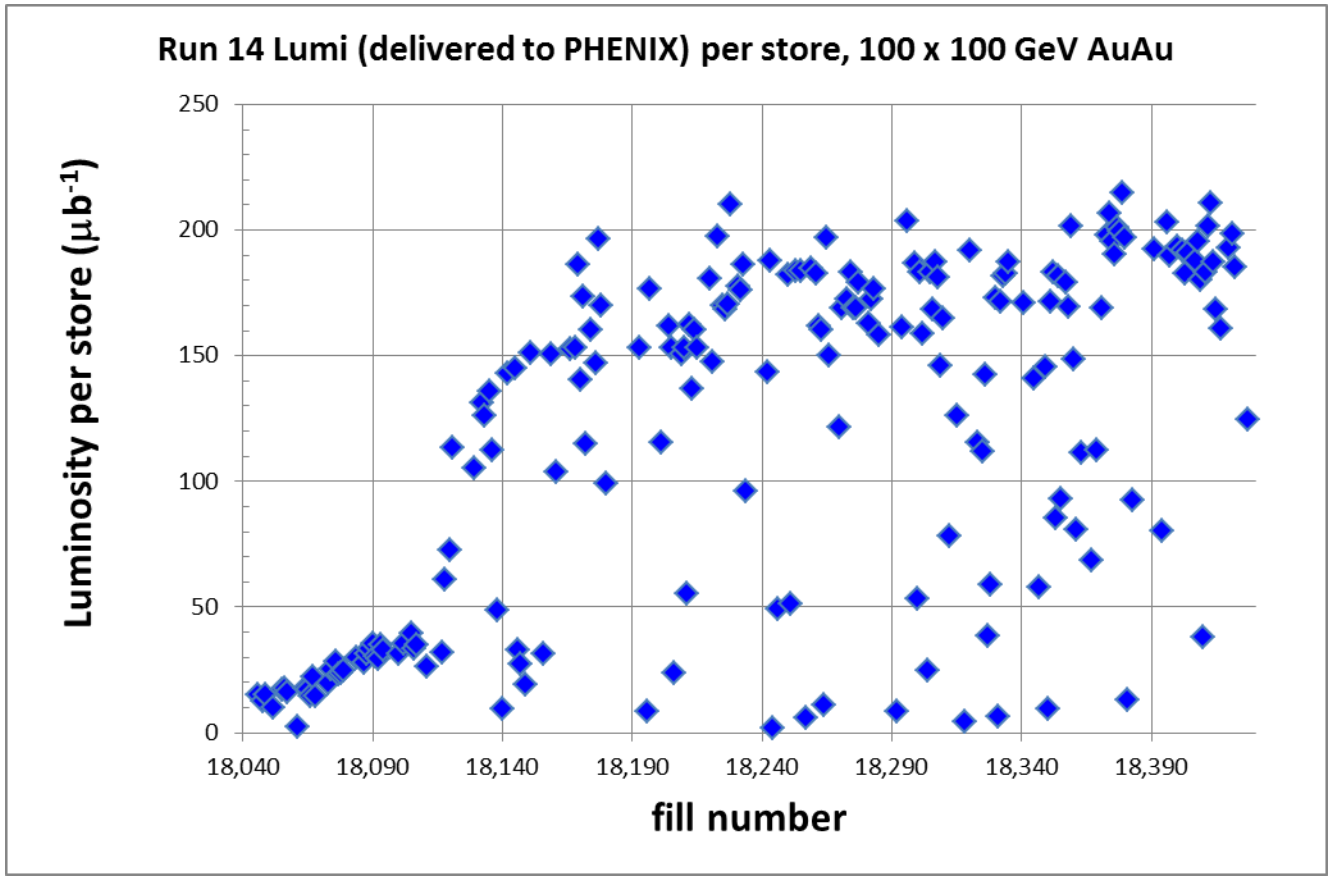


Fischer et. al. “RHIC Collider Projections (FY 2014 – FY 2018)”, 4 June 2013

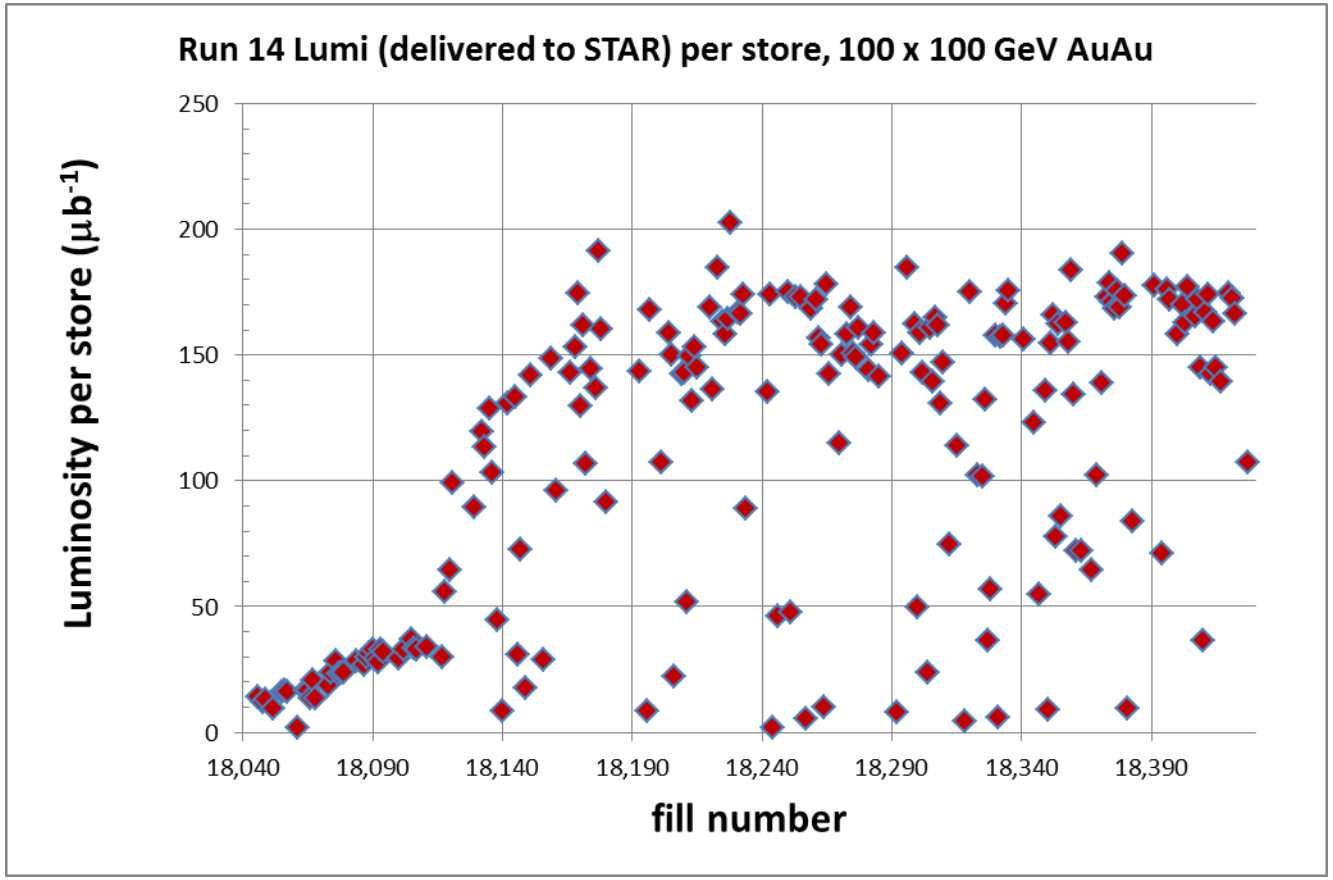
Through final store 18427, 16 June 14



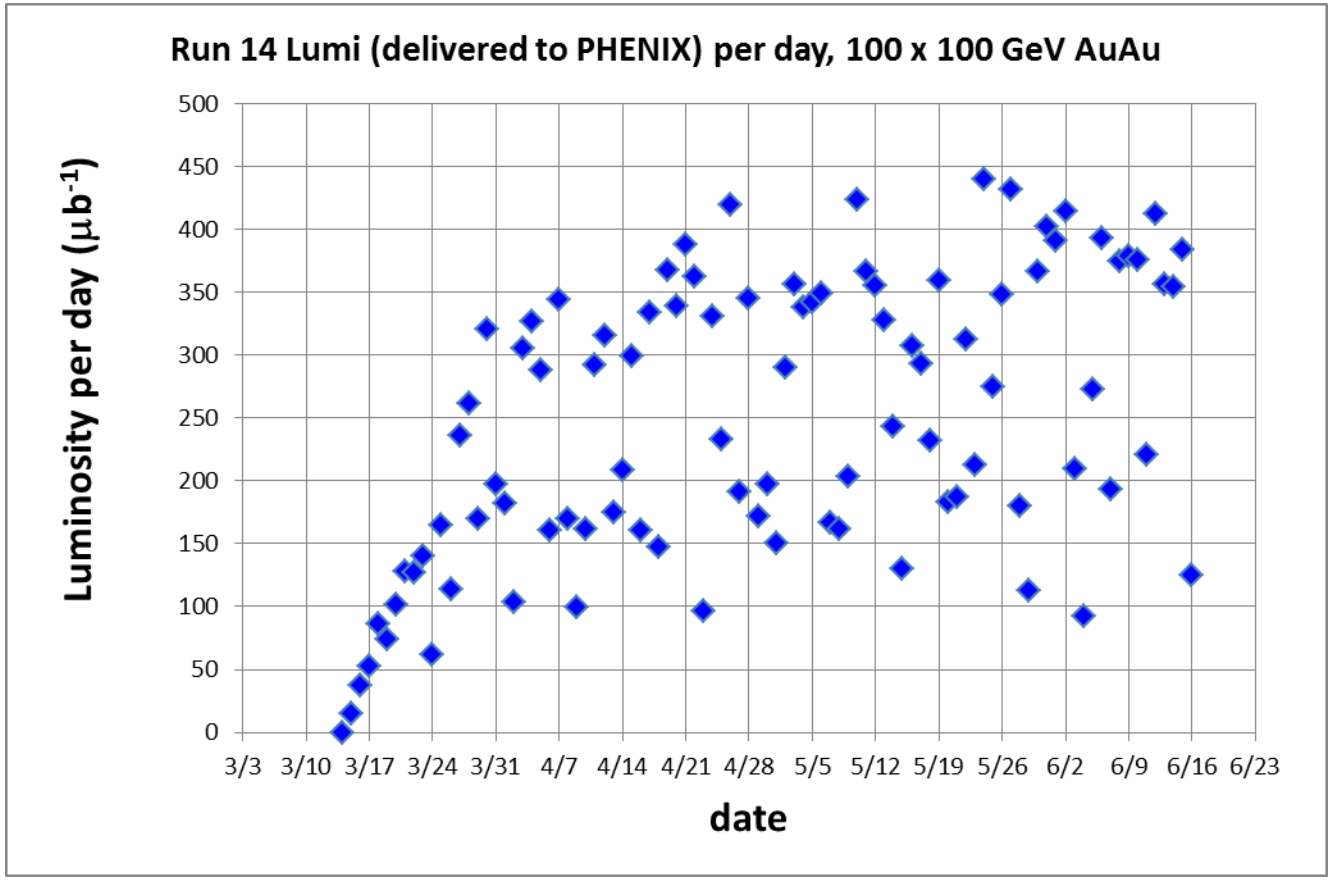
Through final store 18427, 16 June 14



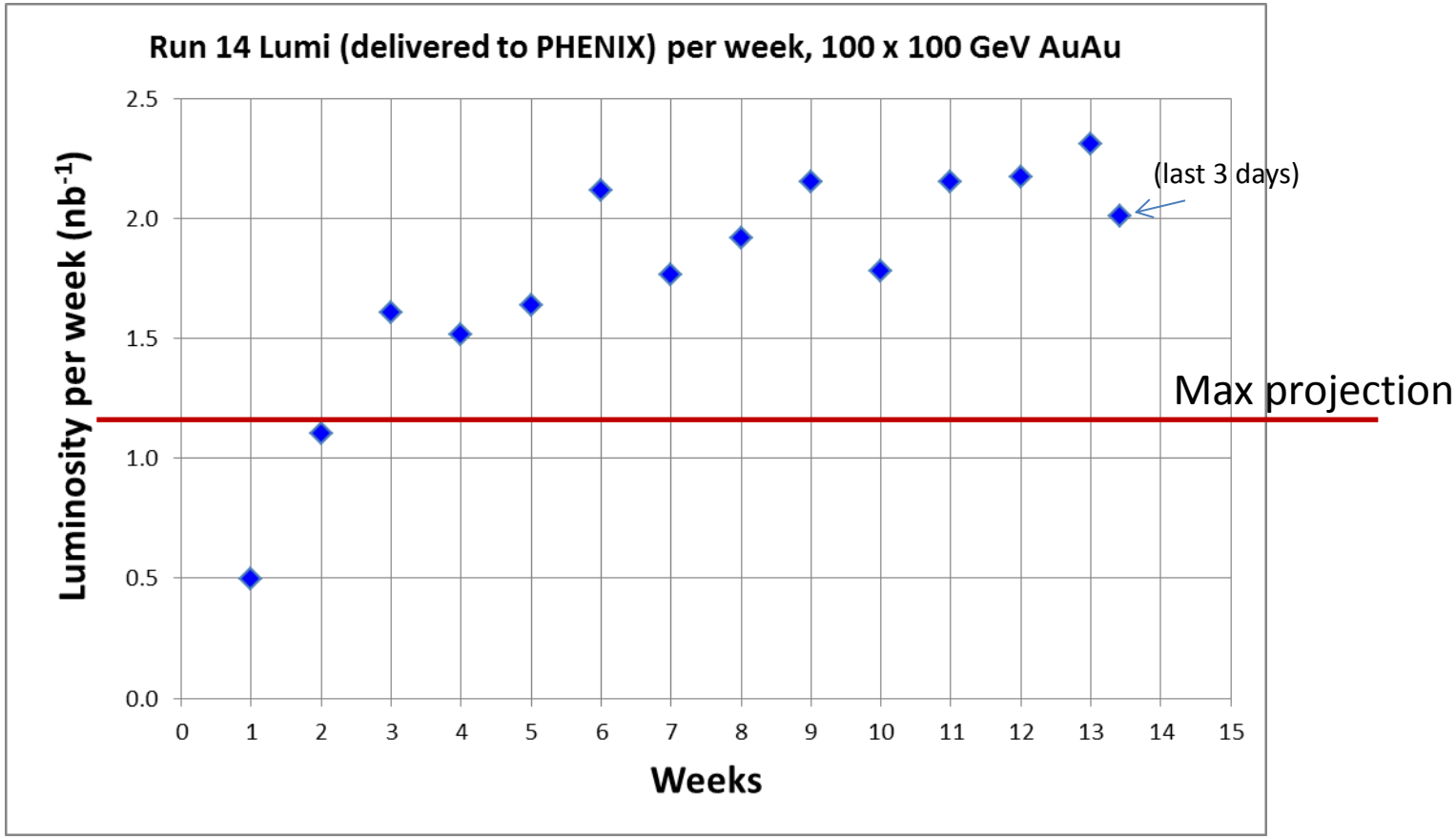
Through final store 18427, 16 June 14



Through final store 18427, 16 June 14

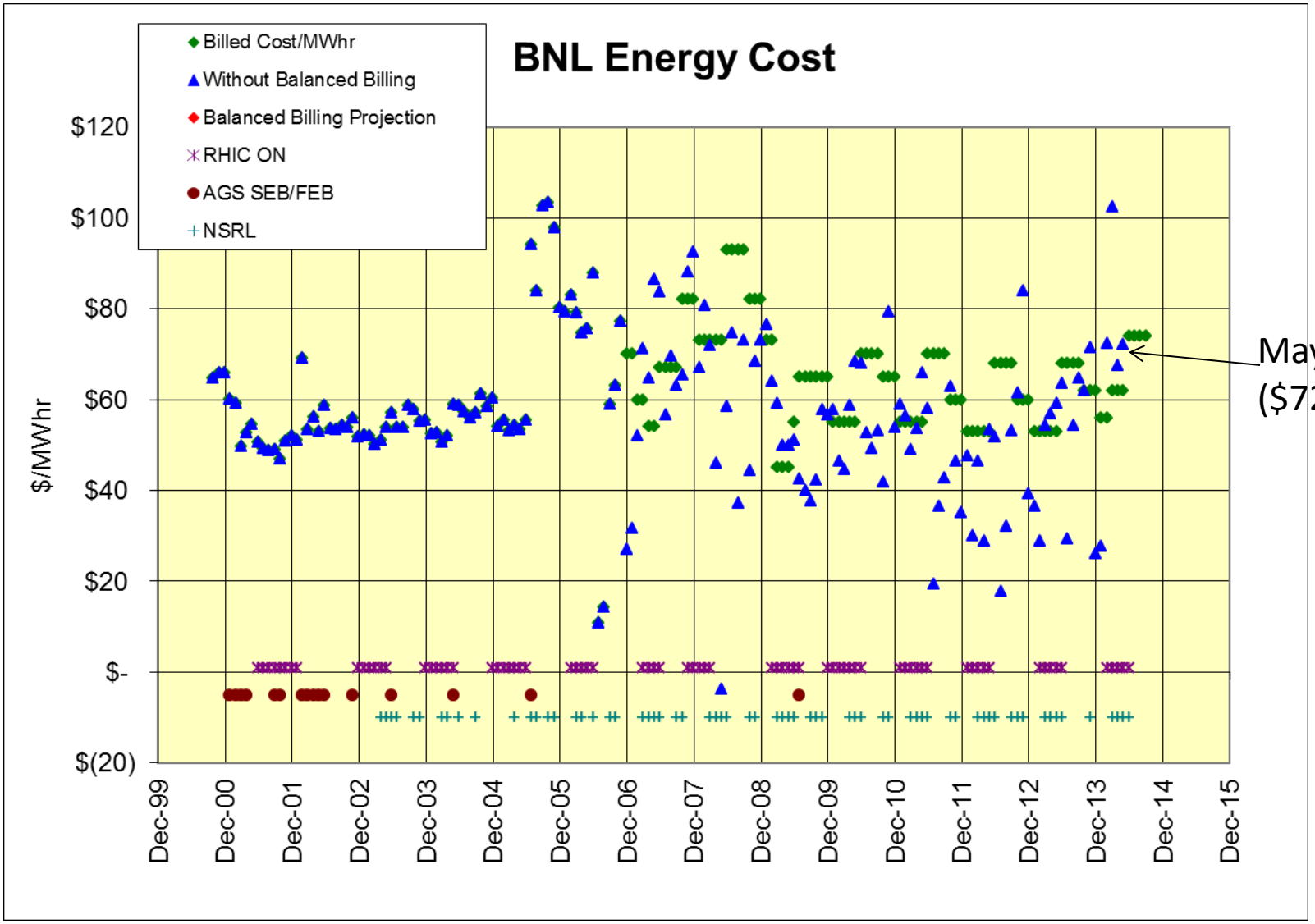


Through final store 18427, 16 June 14

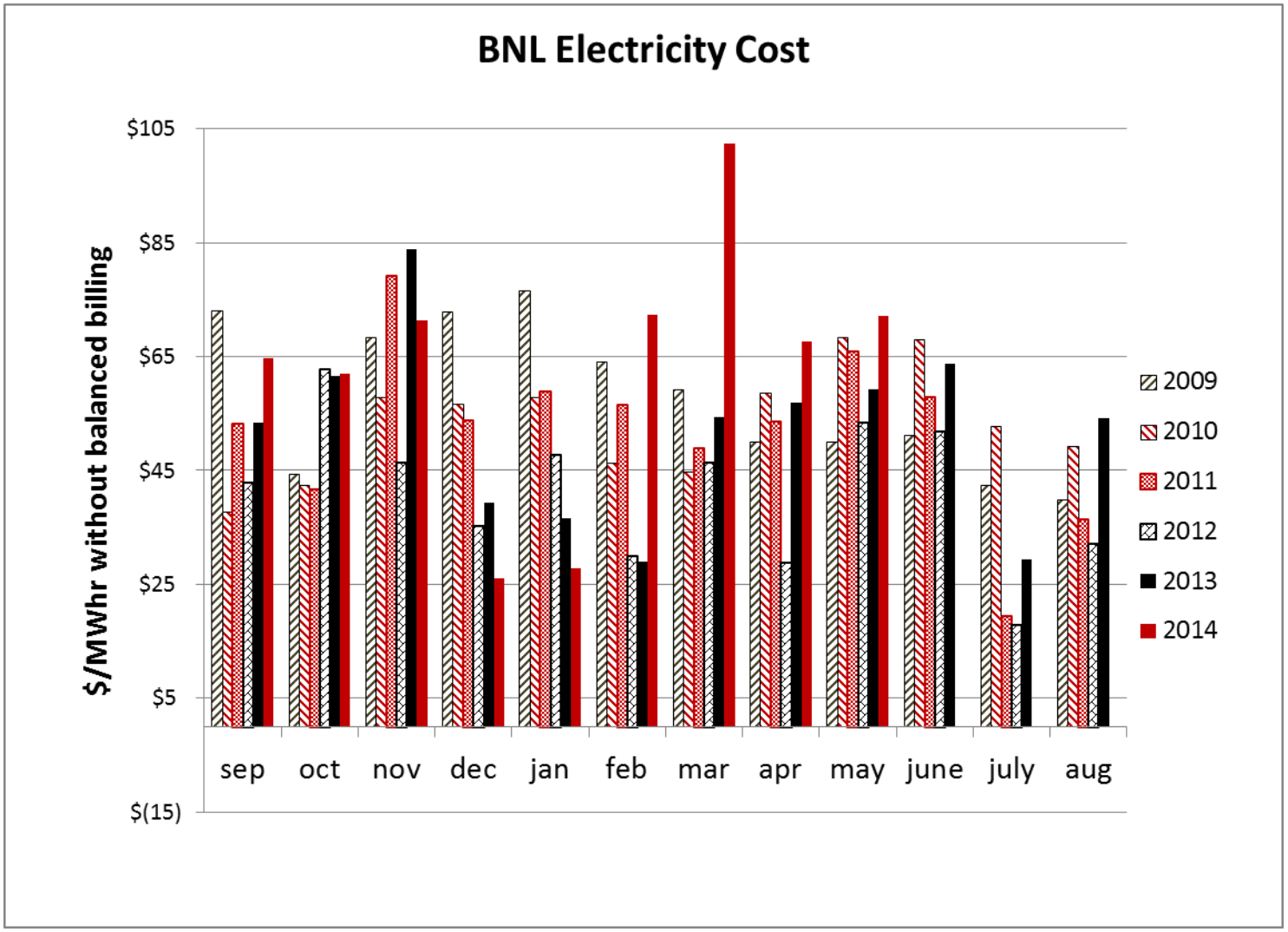


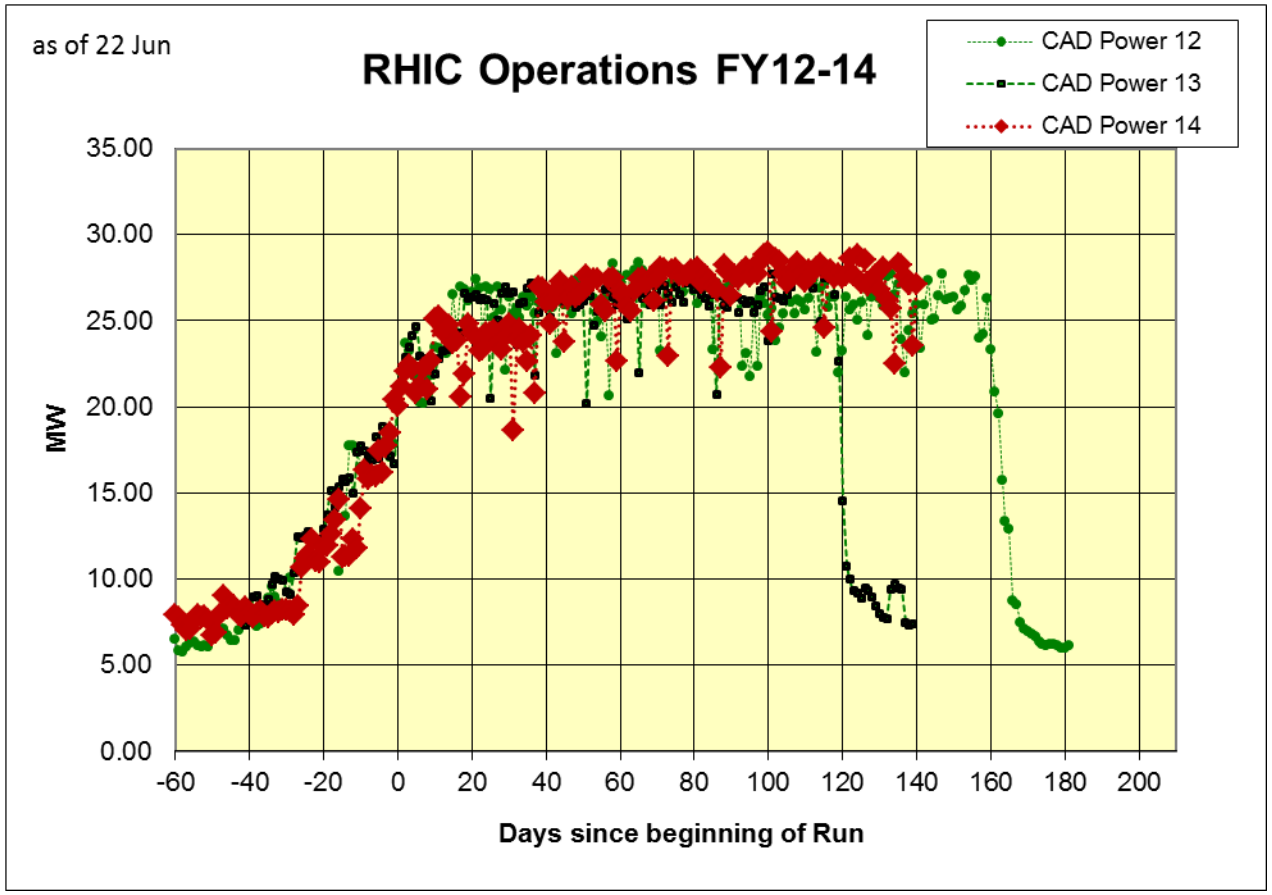
Fischer et. al. “RHIC Collider Projections (FY 2014 – FY 2018)”, 4 June 2013

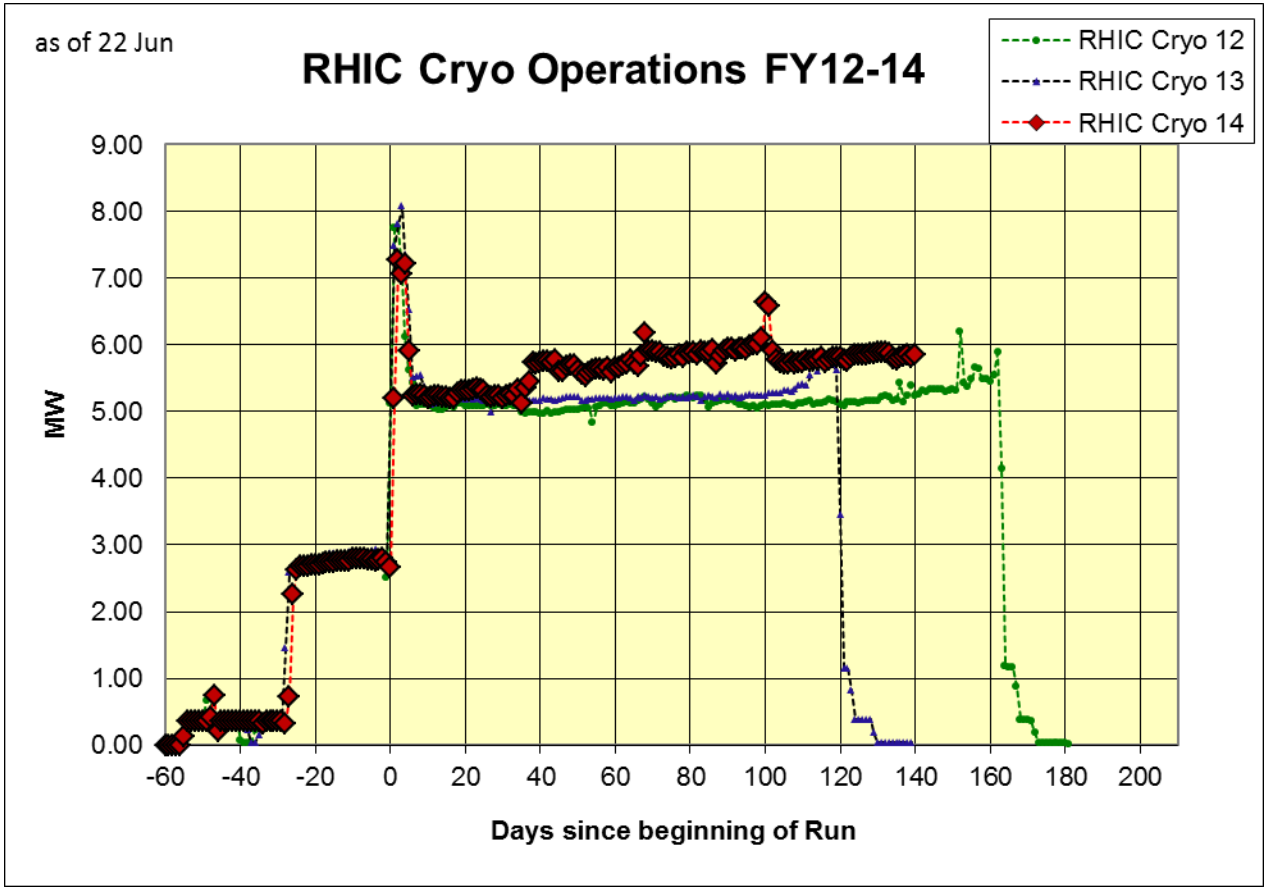
FY 2014 power rebate $ in BNL bank = -$1.21M with ~0.9M of this assignable to C-AD through May



Thru May 2014

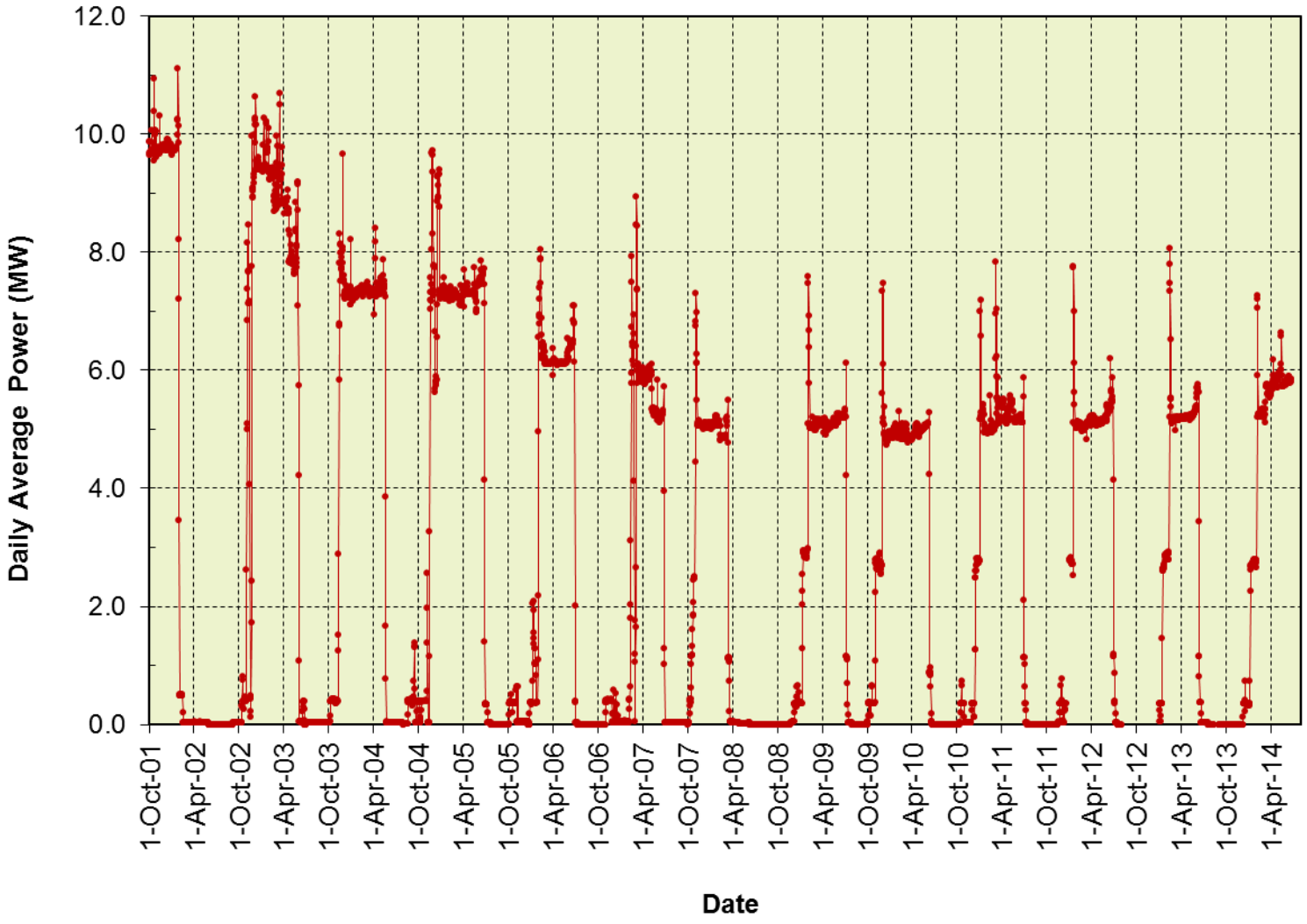


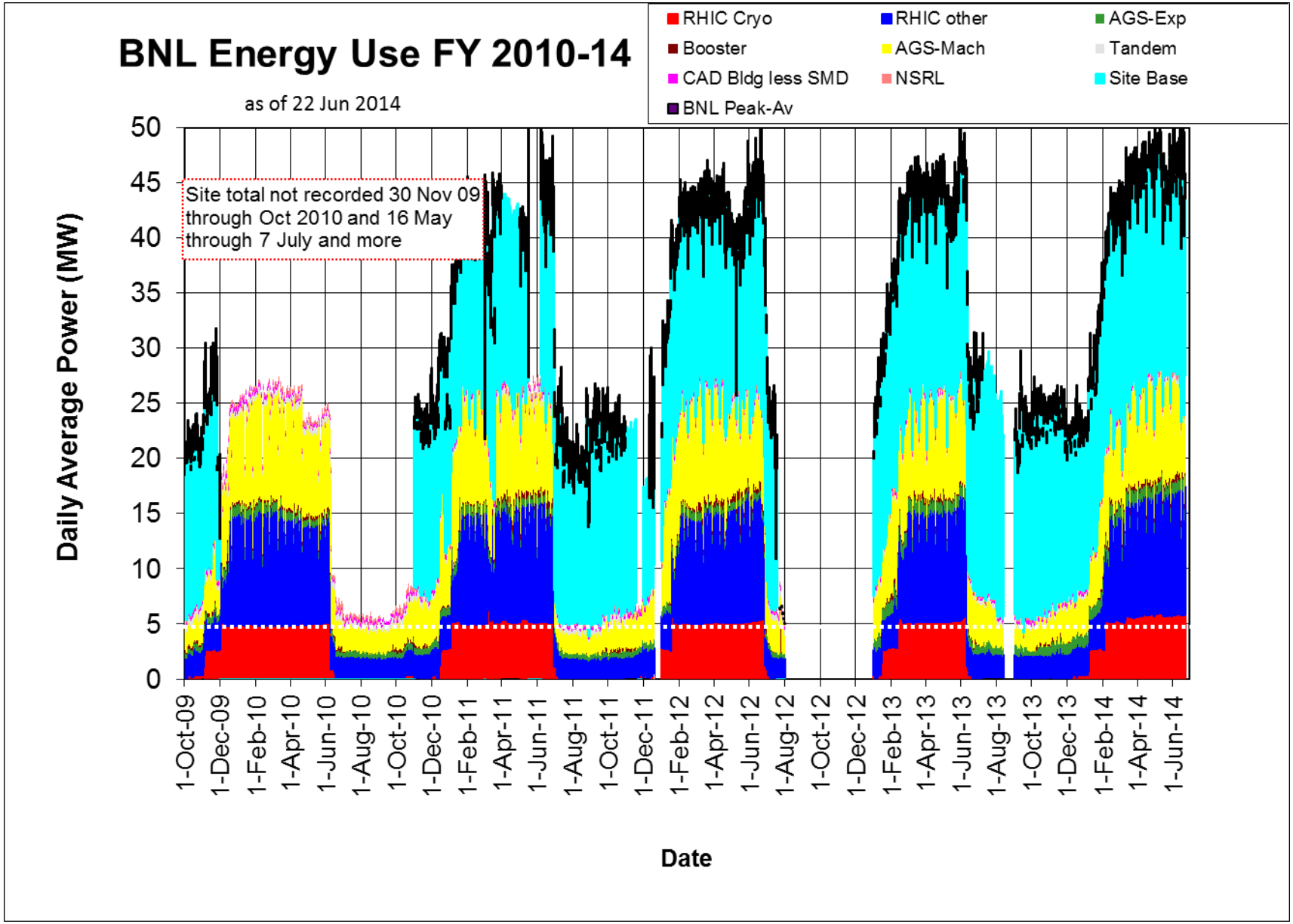

as of 22 Jun
RHIC Operations FY12-14
CAD Power 12
CAD Power 13
CAD Power 14
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
MW
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
Days since beginning of Run


as of 22 Jun
RHIC Cryo Operations FY12-14
RHIC Cryo 12
RHIC Cryo 13
RHIC Cryo 14
MW
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
Days since beginning of Run

as of 22 Jun 2014

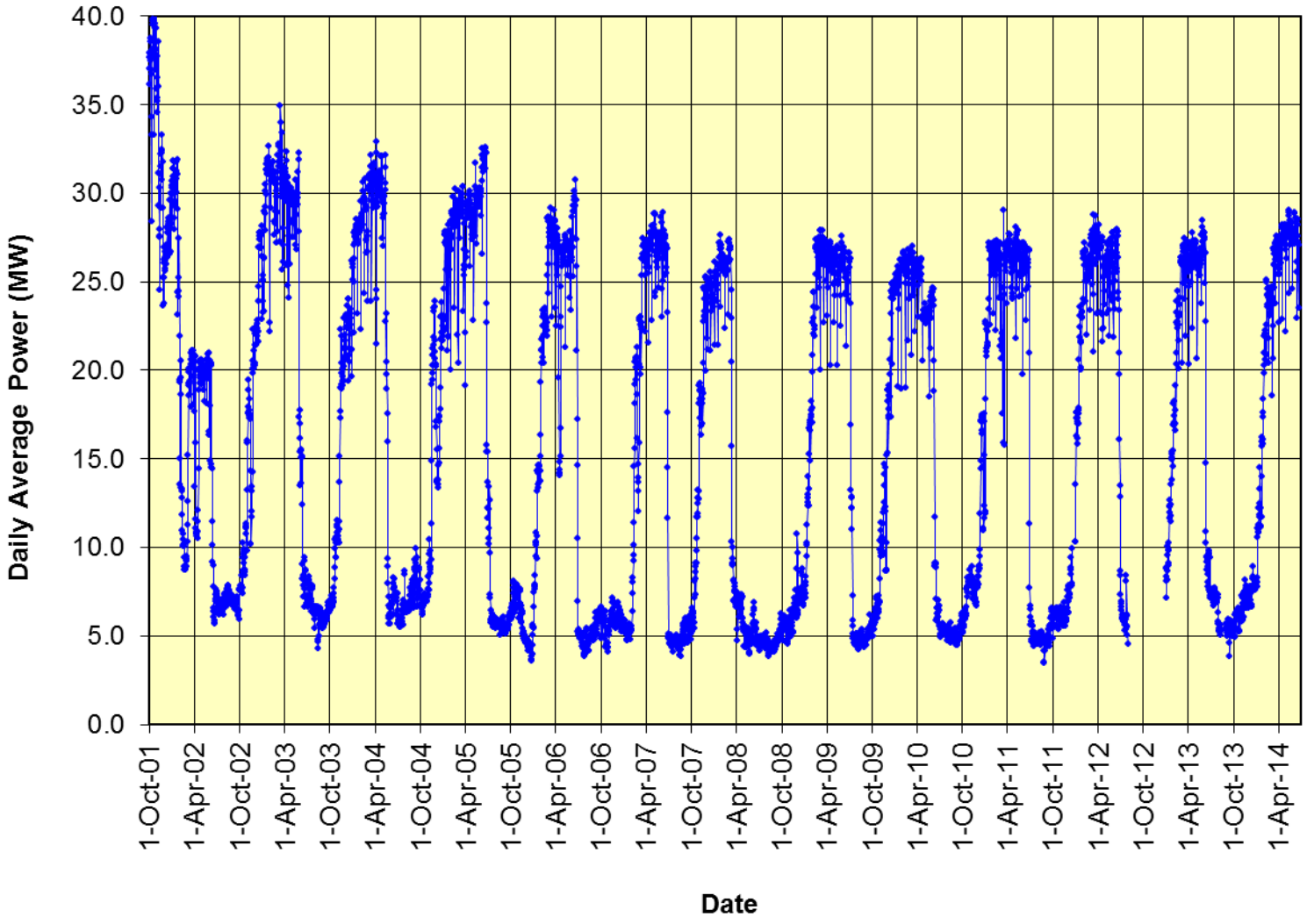
C-AD Cryo Energy Use FY 2002-14

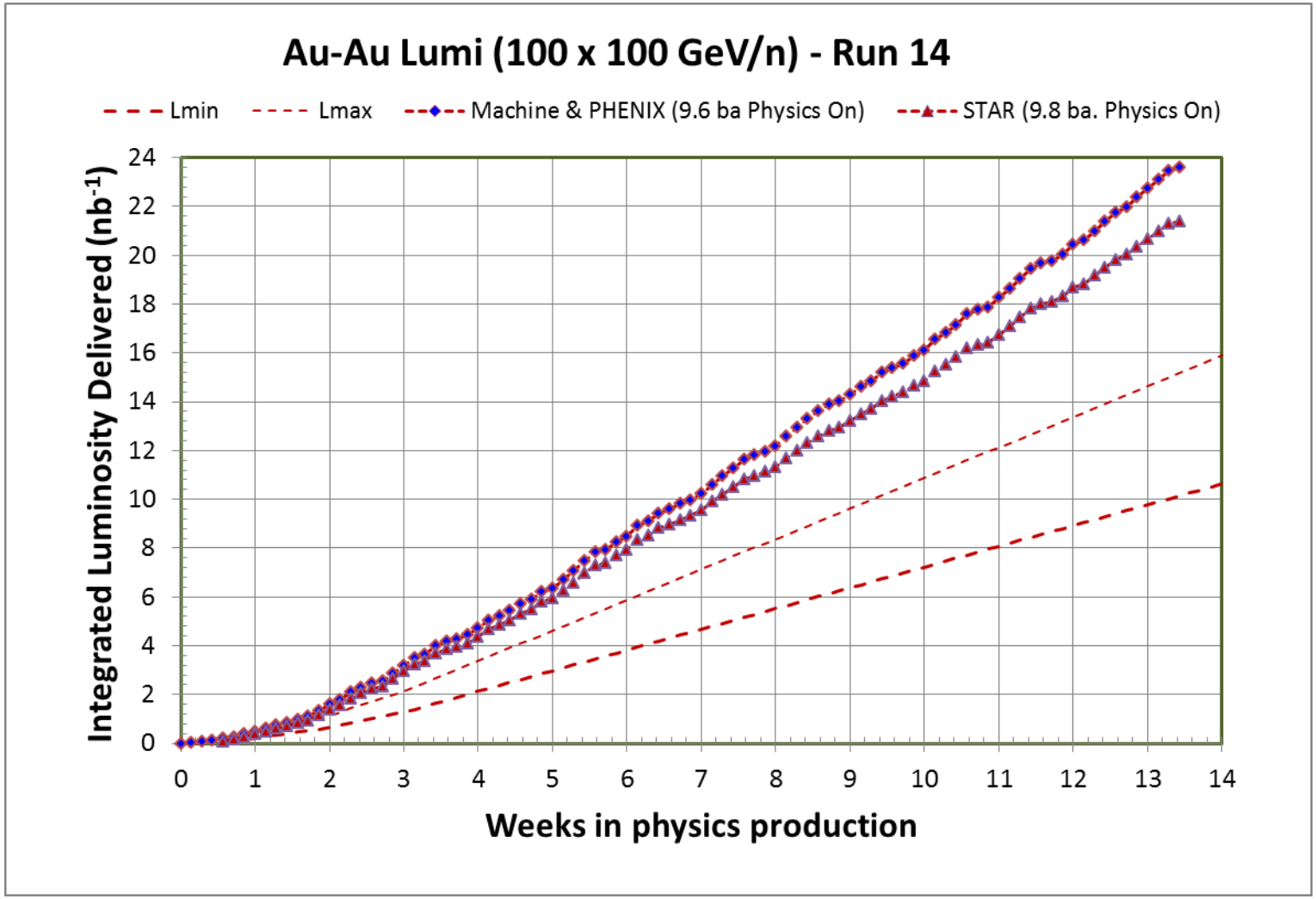



BNL Energy Use FY 2010-14
as of 22 Jun 2014
RHIC Cryo
RHIC other
AGS-Exp
Booster
AGS-Mach
Tandem
CAD Bldg less SMD
NSRL
Site Base
BNL Peak-Av
Site total not recorded 30 Nov 09 through Oct 2010 and 16 May through 7 July and more
Daily Average Power (MW)
0
5
10
15
20
25
30
35
40
45
50
1-Oct-09
1-Dec-09
1-Feb-10
1-Apr-10
1-Jun-10
1-Aug-10
1-Oct-10
1-Dec-10
1-Feb-11
1-Apr-11
1-Jun-11
1-Aug-11
1-Oct-11
1-Dec-11
1-Feb-12
1-Apr-12
1-Jun-12
1-Aug-12
1-Oct-12
1-Dec-12
1-Feb-13
1-Apr-13
1-Jun-13
1-Aug-13
1-Oct-13
1-Dec-13
1-Feb-14
1-Apr-14
1-Jun-14
Date

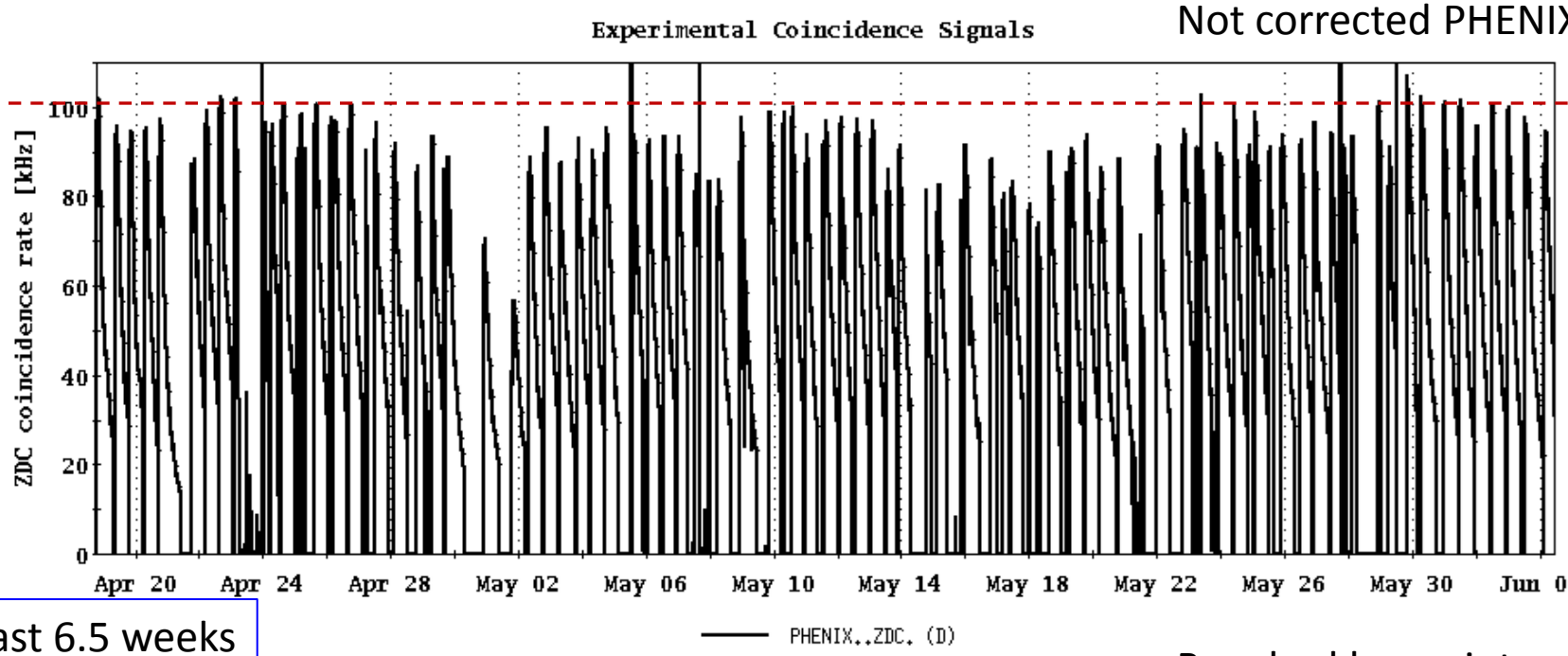
as of 22 Jun 2014

C-AD Energy Use FY 2002-14



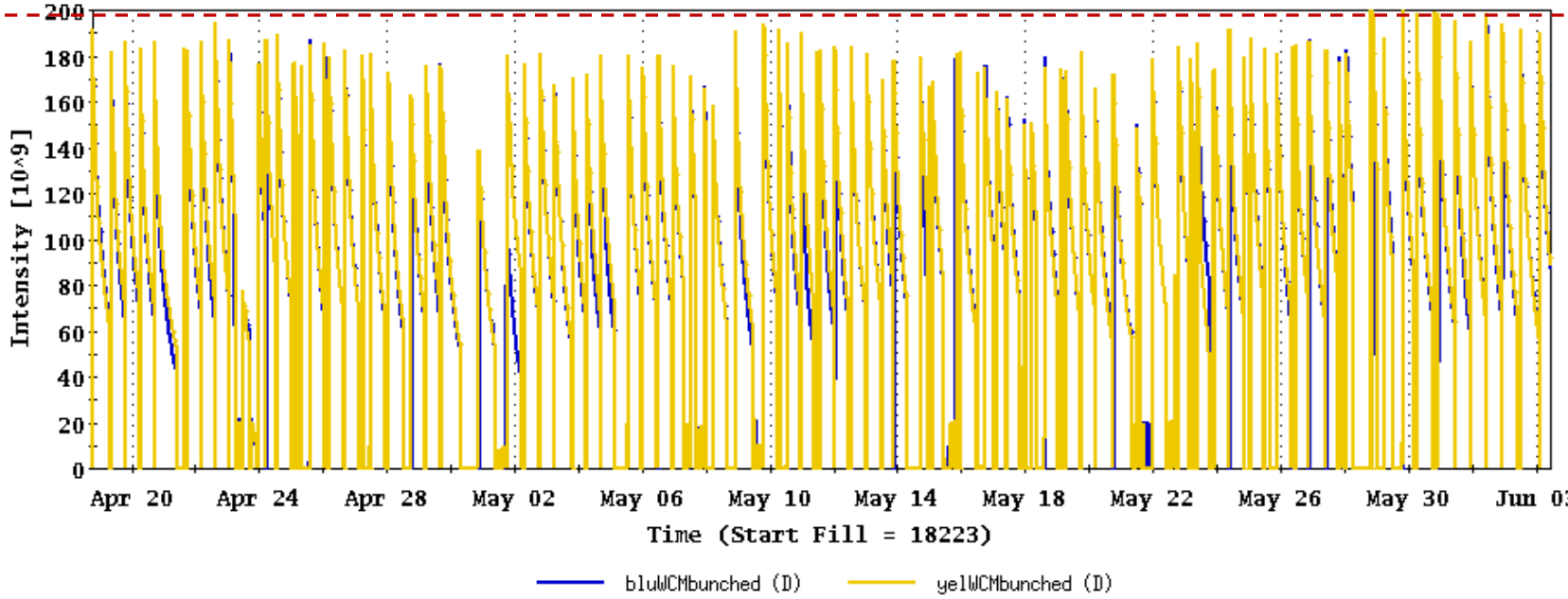

Au-Au Lumi (100 x 100 GeV/n) - Run 14
Lmin
Lmax
Machine & PHENIX (9.6 ba Physics On)
STAR (9.8 ba. Physics On)
Integrated Luminosity Delivered (nb-1)
0
2
4
6
8
10
12
14
16
18
20
22
24
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Weeks in physics production

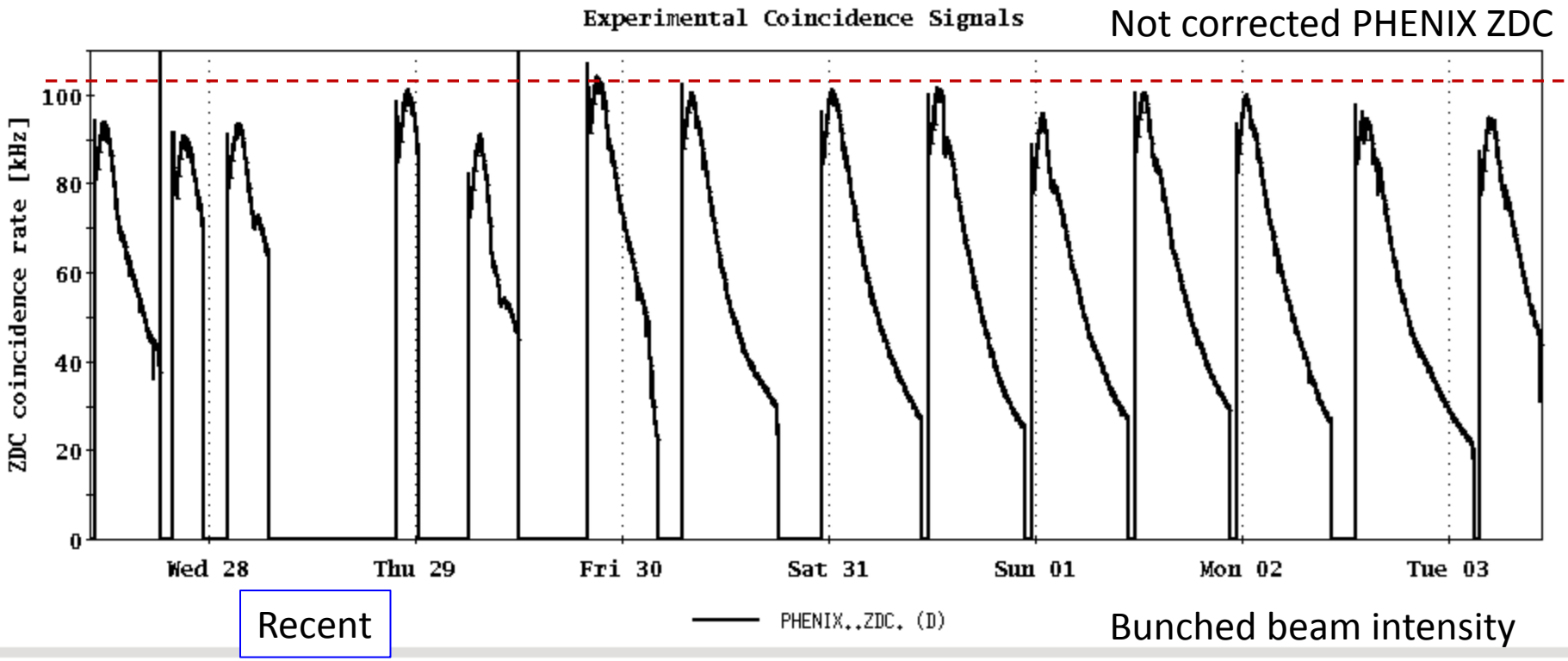
Not corrected PHENIX ZDC



Past 6.5 weeks

Bunched beam intensity

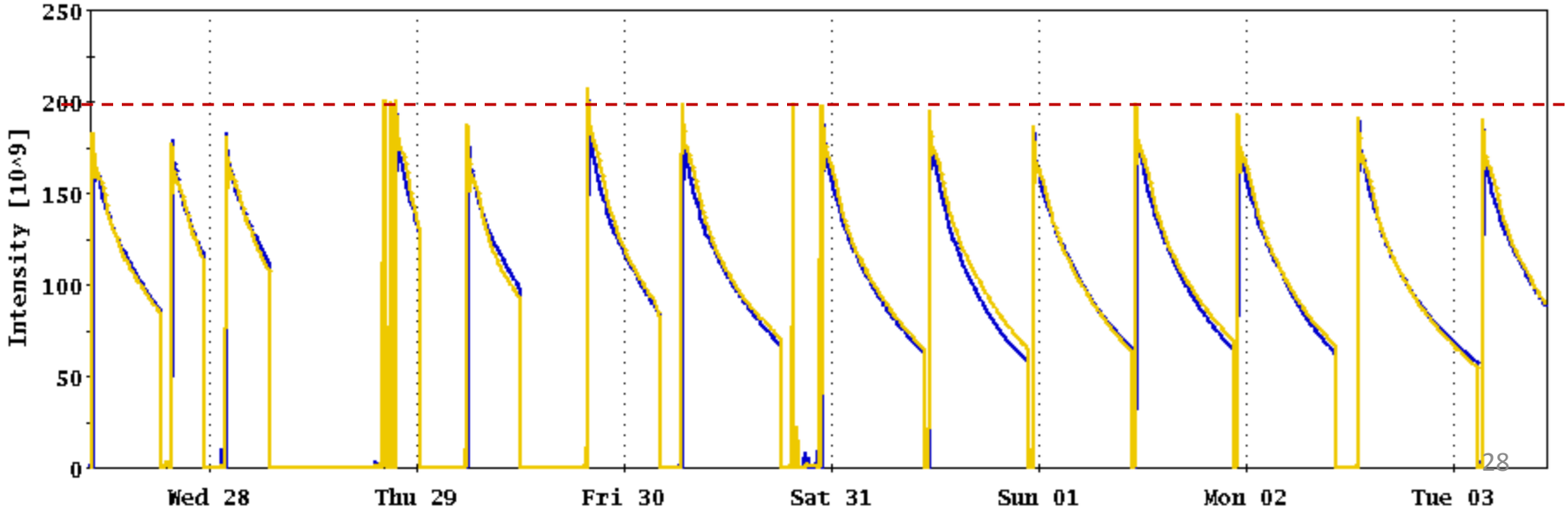


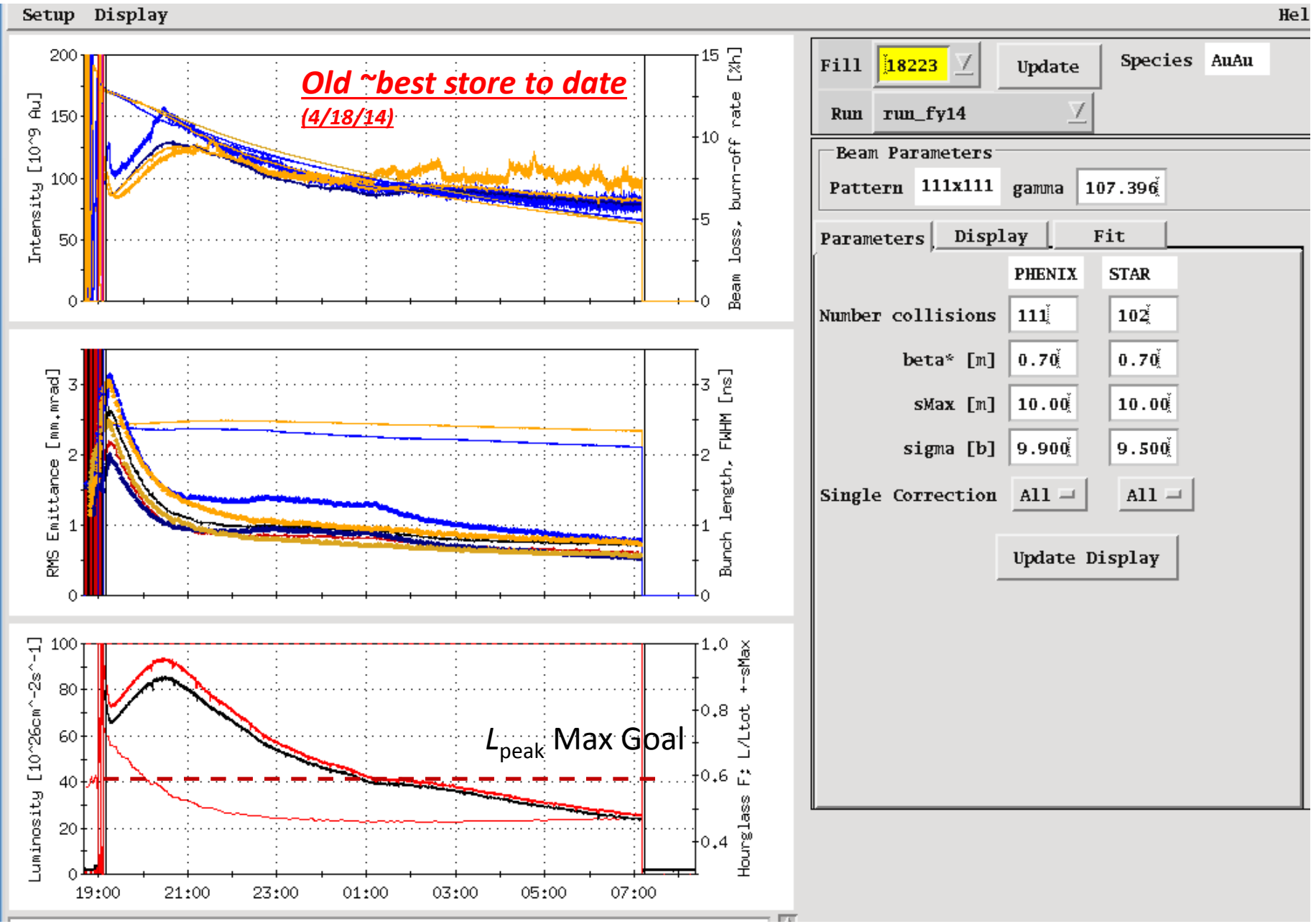


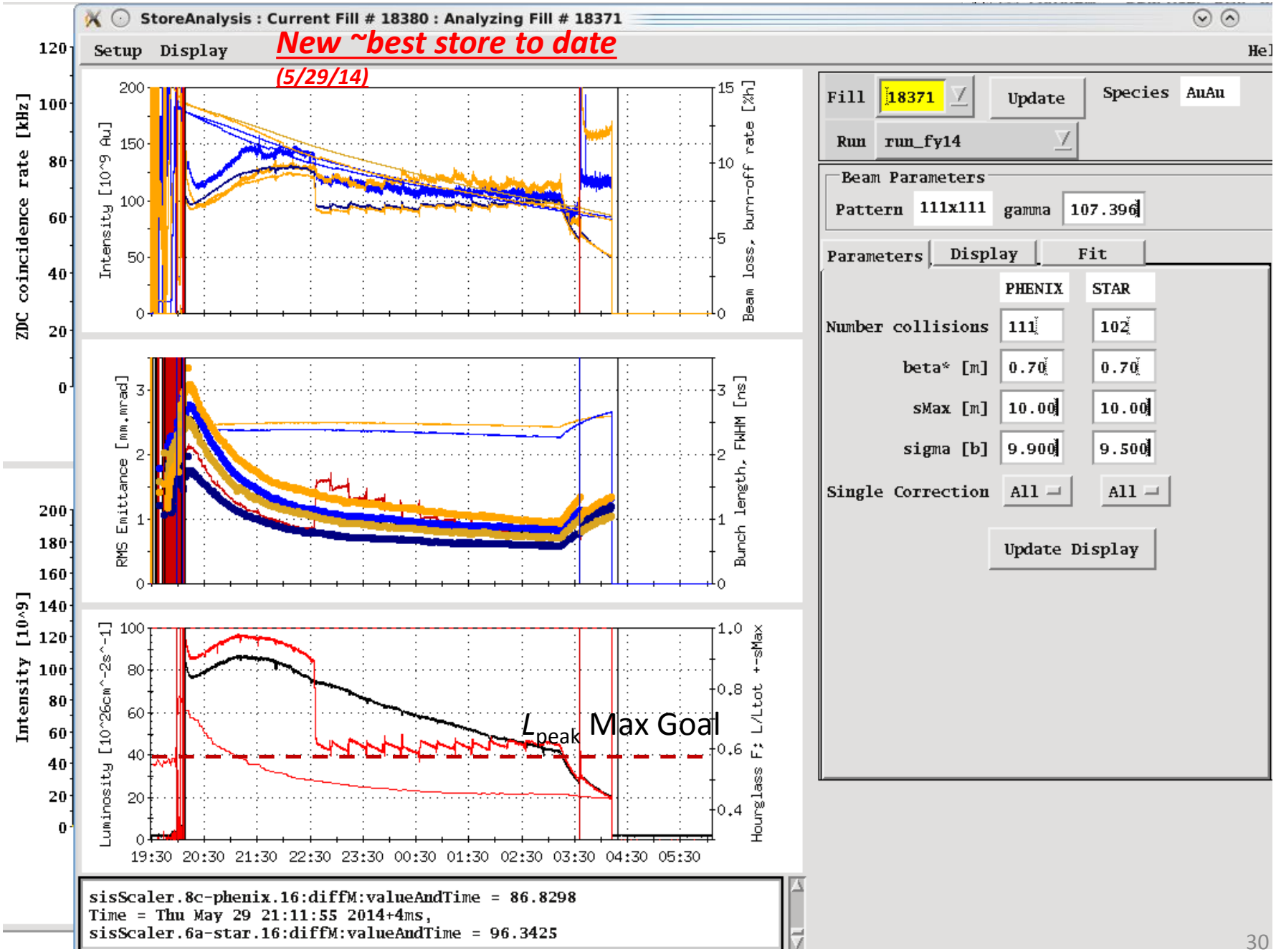
Not corrected PHENIX ZDC

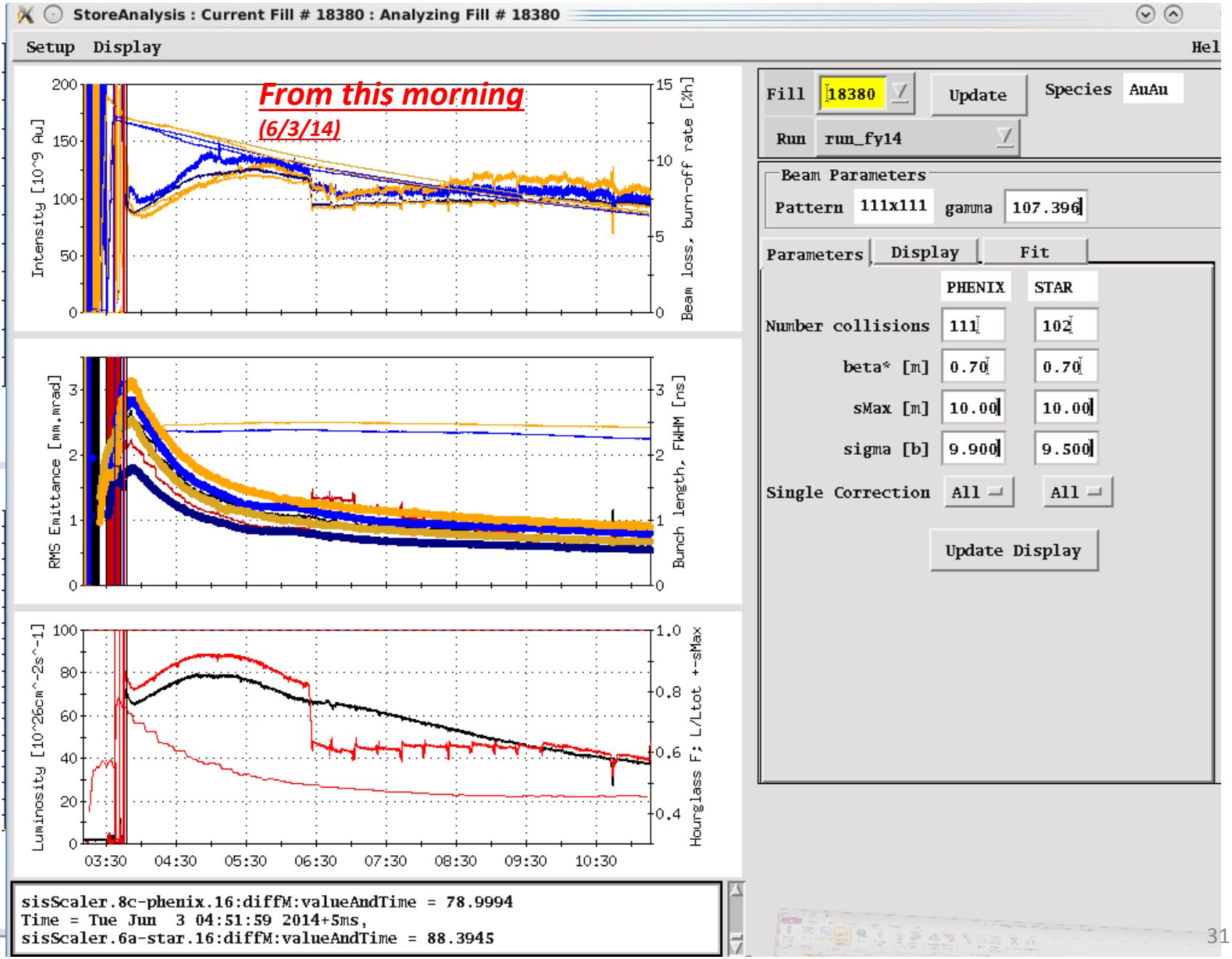
Recent

Bunched beam intensity

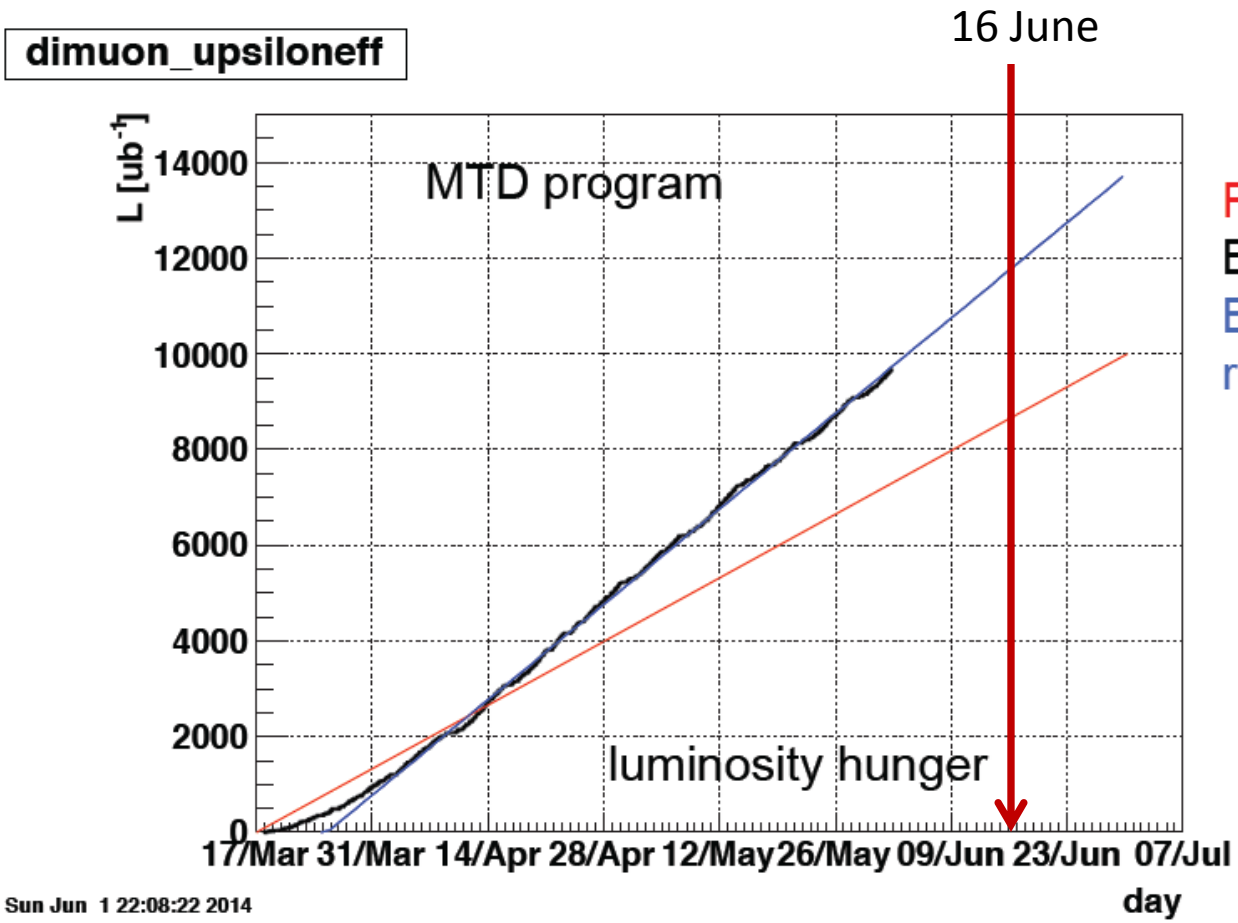



Setup Display
Hel
Old ~best store to date
(4/18/14)
Intensity [10^9 Au]
Beam loss, burn-off rate [%h]
RMS Emittance [mm.mrad]
Bunch length, FWHM [ns]
Luminosity [10^26cm^-2s^-1]
Hourglass F; L/Ltot +-sMax
L_{peak} Max Goal
19:00
21:00
23:00
01:00
03:00
05:00
07:00
Fill 18223
Update
Species AuAu
Run run_fy14
Beam Parameters
Pattern 111x111
gamma 107.396
Parameters
Display
Fit
PHENIX
STAR
Number collisions 111 102
beta* [m] 0.70 0.70
sMax [m] 10.00 10.00
sigma [b] 9.900 9.500
Single Correction All All
Update Display


StoreAnalysis : Current Fill # 18380 : Analyzing Fill # 18371
Setup Display
New ~best store to date
(5/29/14)
Fill 18371 Update Species AuAu
Run run_fy14
Beam Parameters
Pattern 111x111 gamma 107.396
Parameters Display Fit
PHENIX STAR
Number collisions 111 102
beta* [m] 0.70 0.70
sMax [m] 10.00 10.00
sigma [b] 9.900 9.500
Single Correction All All
Update Display
ZDC coincidence rate [kHz]
Intensity [10^9 Au]
Beam loss, burn-off rate [%/h]
RMS Emittance [mm.mrad]
Bunch length, FWHM [ns]
Intensity [10^9]
Luminosity [10^26cm^-2s^-1]
Hourglass F; L/Ltot +-sMax
L_{peak} Max Goal
19:30 20:30 21:30 22:30 23:30 00:30 01:30 02:30 03:30 04:30 05:30
sisScaler.8c-phenix.16:diffM:valueAndTime = 86.8298
Time = Thu May 29 21:11:55 2014+4ms,
sisScaler.6a-star.16:diffM:valueAndTime = 96.3425

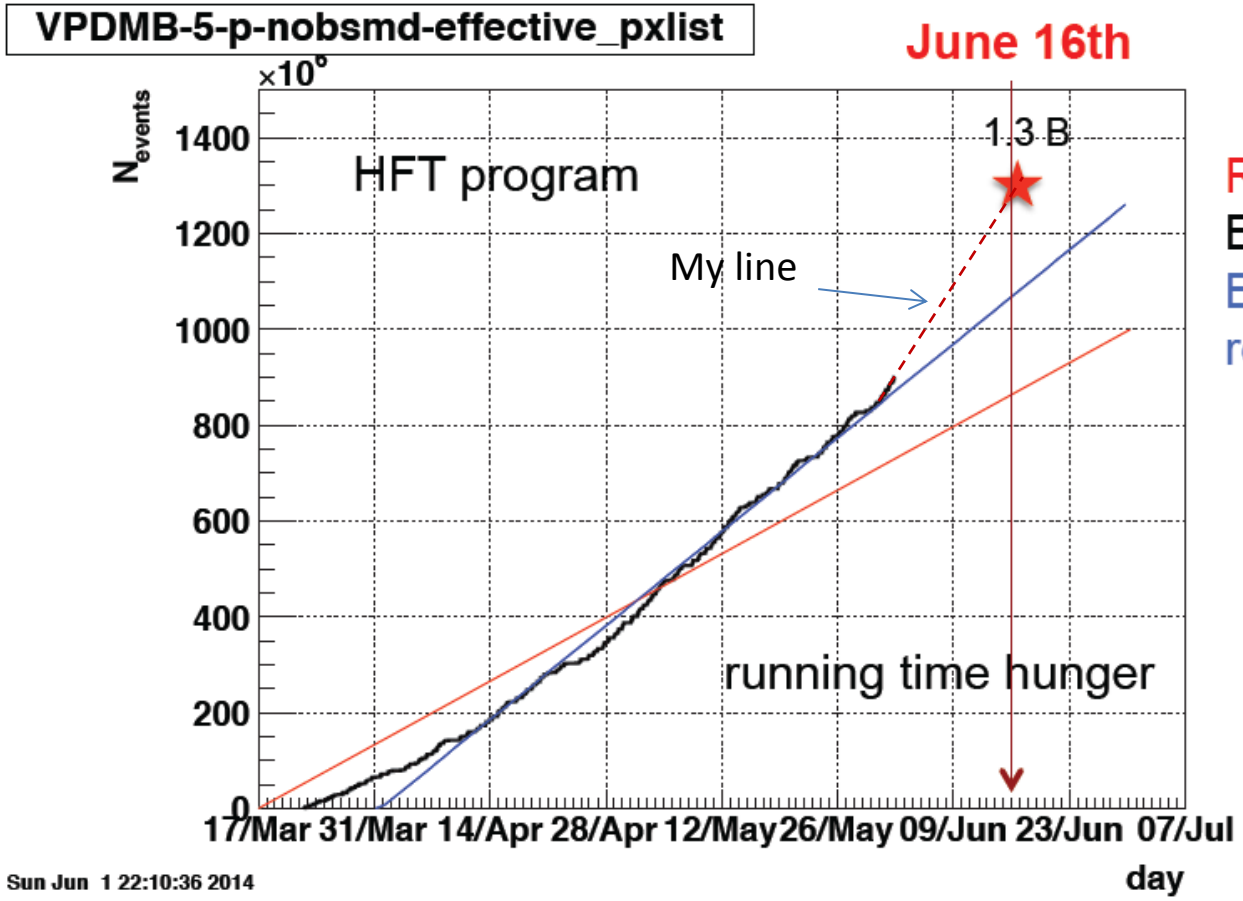

StoreAnalysis : Current Fill # 18380 : Analyzing Fill # 18380
Setup
Display
Hel
From this morning
(6/3/14)
Intensity [10^9 Au]
Beam loss, burn-off rate [%h]
RMS Emittance [mm.mrad]
Bunch length, FWHM [ns]
Luminosity [10^26cm^-2s^-1]
Hourglass F; L/Ltot +-sMax
03:30
04:30
05:30
06:30
07:30
08:30
09:30
10:30
ZDC coincidence rate [kHz]
Intensity [10^9]
Fill
18380
Update
Species
AuAu
Run
run_fy14
Beam Parameters
Pattern
111x111
gamma
107.396
Parameters
Display
Fit
PHENIX
STAR
Number collisions
111
102
beta* [m]
0.70
0.70
sMax [m]
10.00
10.00
sigma [b]
9.900
9.500
Single Correction
All
All
Update Display
sisScaler.8c-phenix.16:diffM:valueAndTime = 78.9994
Time = Tue Jun 3 04:51:59 2014+5ms,
sisScaler.6a-star.16:diffM:valueAndTime = 88.3945

STAR – Slides from Time Meeting



Red: goal
Black: STAR performance
Blue: projection based on recent ~6 weeks

Luminosity hunger trigger (MTD program) looks pretty good
But always better with more statistics (Upsilon)!



Red: goal

Black: STAR performance

Blue: projection based on recent ~6 weeks

- Due to acceptance loss in PXL detector caused by beam radiation, we need ~30 % more events to have the same quality of physics result.
- Re-optimizing at STAR increases HFT data rate by ~ 8% per hour store
- We need more time at store for Au+Au@200GeV!

STAR Proposal for optimum running

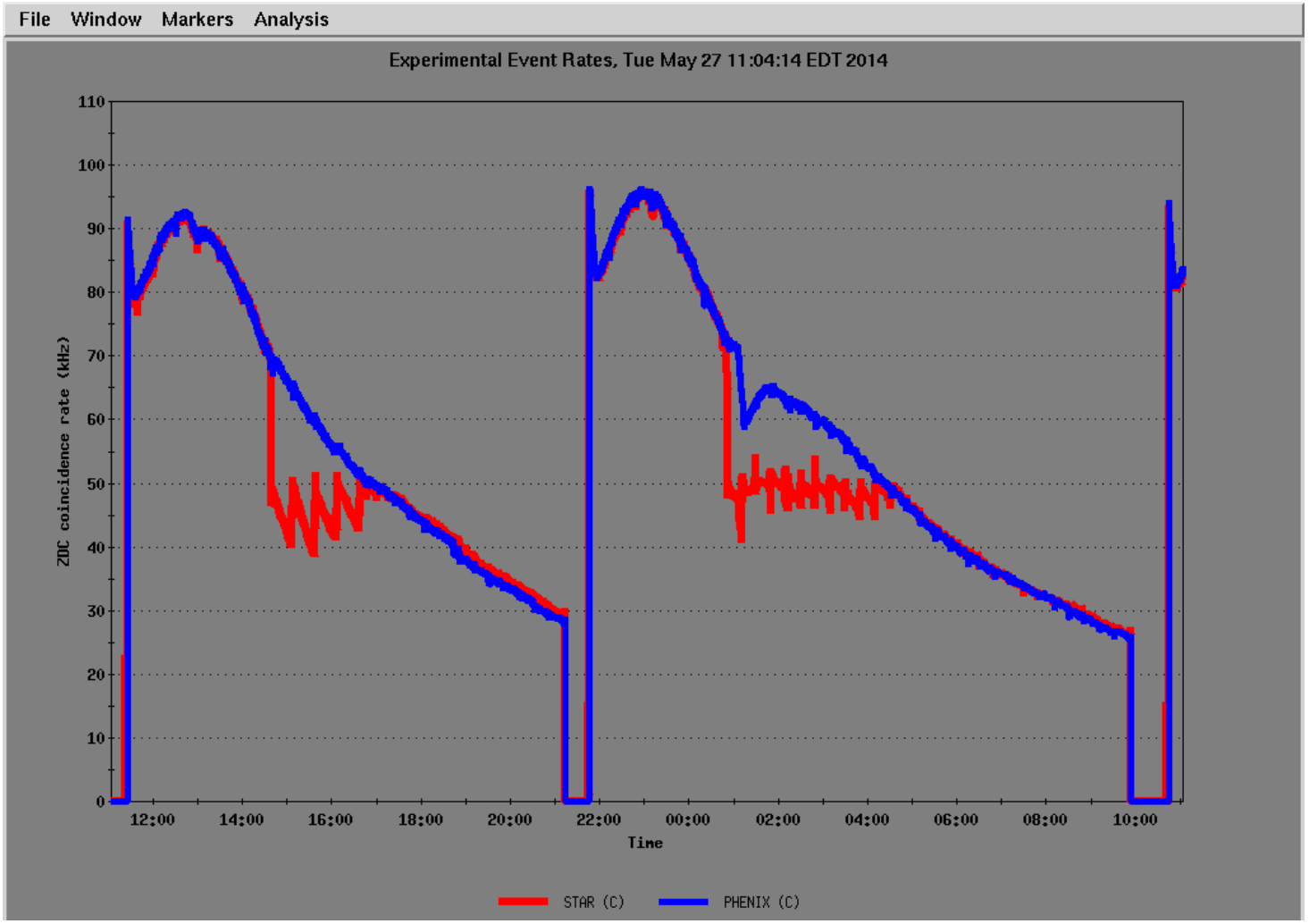
Proposal for optimizing RHIC Running between now and switch to He3- Au

RHIC Coordination mtg.

May 27, 2014

Bill Christie

For the STAR Collaboration



Proposal:

1.) Drop the collision rate in STAR down to 50 kHz 2.5 hours into the store, as opposed the current mode where it's dropped after 3 hours.

2.) Extend the store length from 10 hours to 11 hours.

3.) Minimize Machine Development time between now and the switchover to He3-Au running.

4.) Consider dropping one APEX session between now and the switchover to He3-Au running.

5.) Investigate implementing the dynamic Beta squeeze (aka THOR) at STAR late in the store when the 50 kHz rate can't be maintained.

6.) Consider gains in the luminosity lifetime that could result from either mis steering PHENIX or increasing the PHENIX beta*.

7.) Depending on how far we get in reaching STAR's goal's, reconsider the He3-Au switch over date.

http://www.bnl.gov/cad/esfd

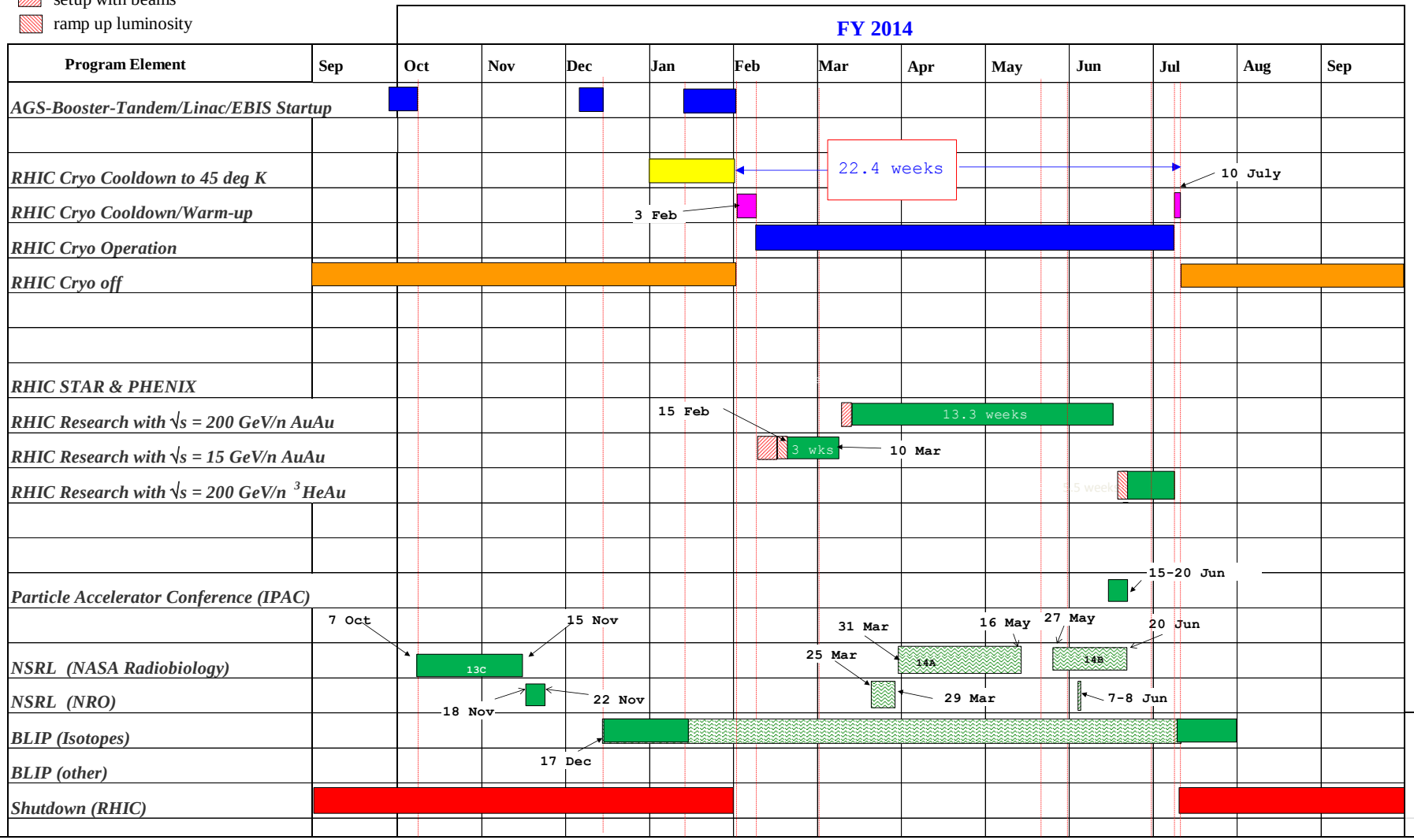
Scheduling Physicist: Chuyu Liu

C-A Operations-FY14

20 May 14

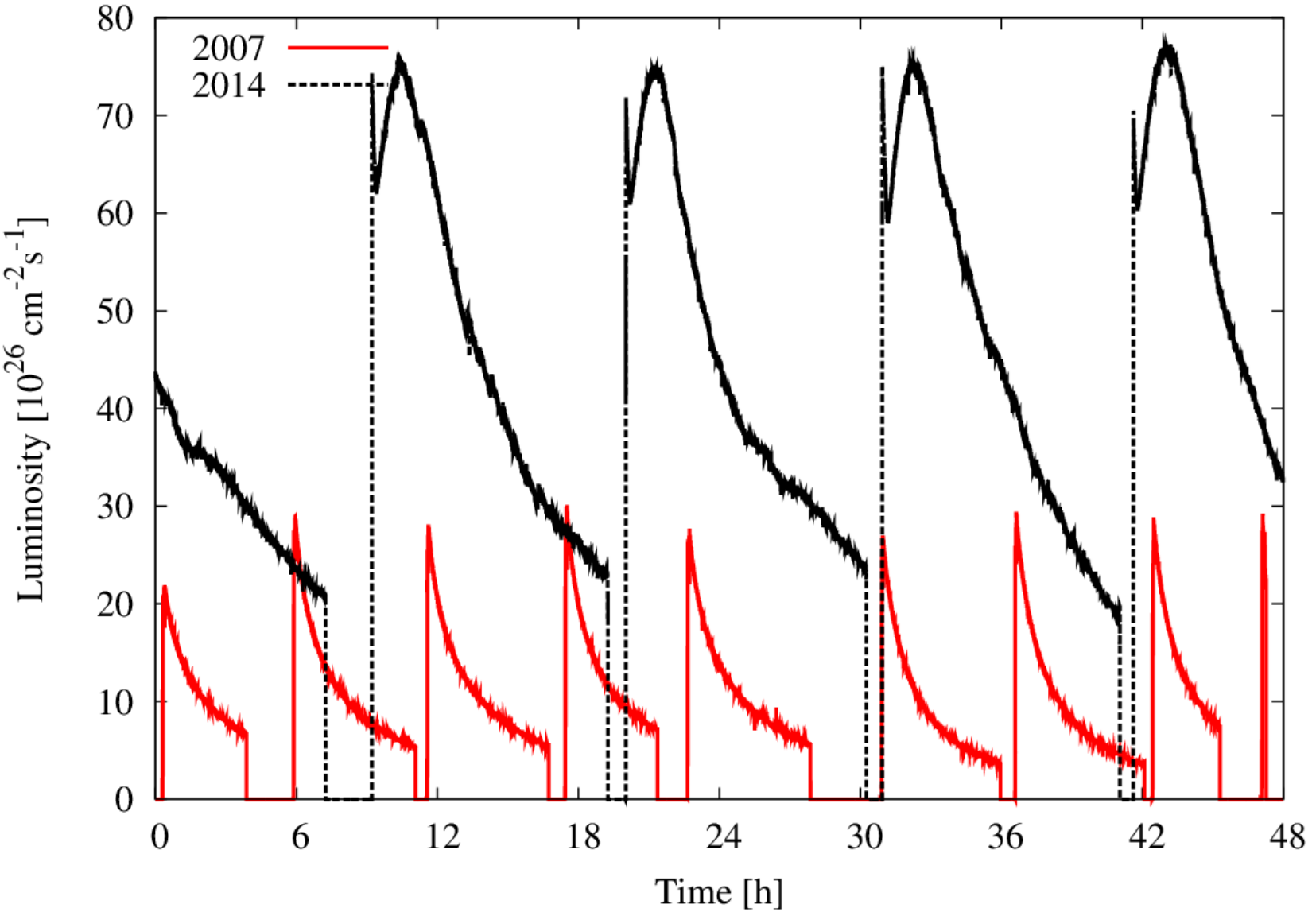
concurrent with RHIC
setup with beams
ramp up luminosity

planned, budget permitting

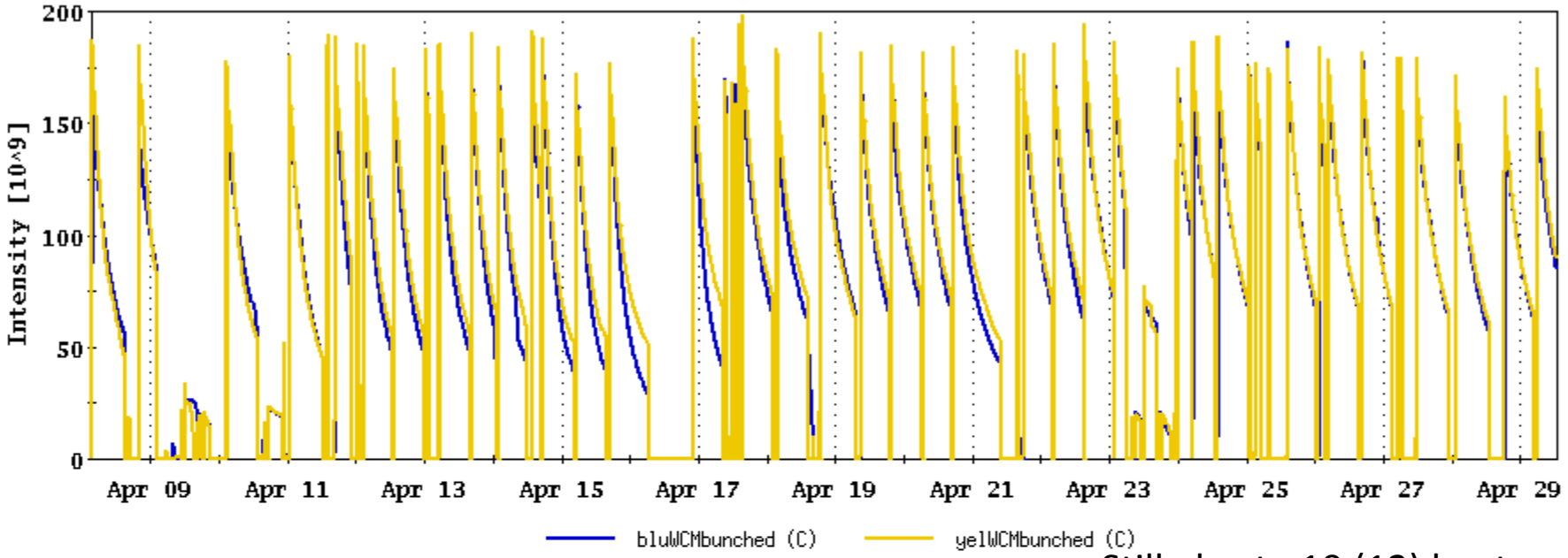


From Wolfram, 5/6/2014

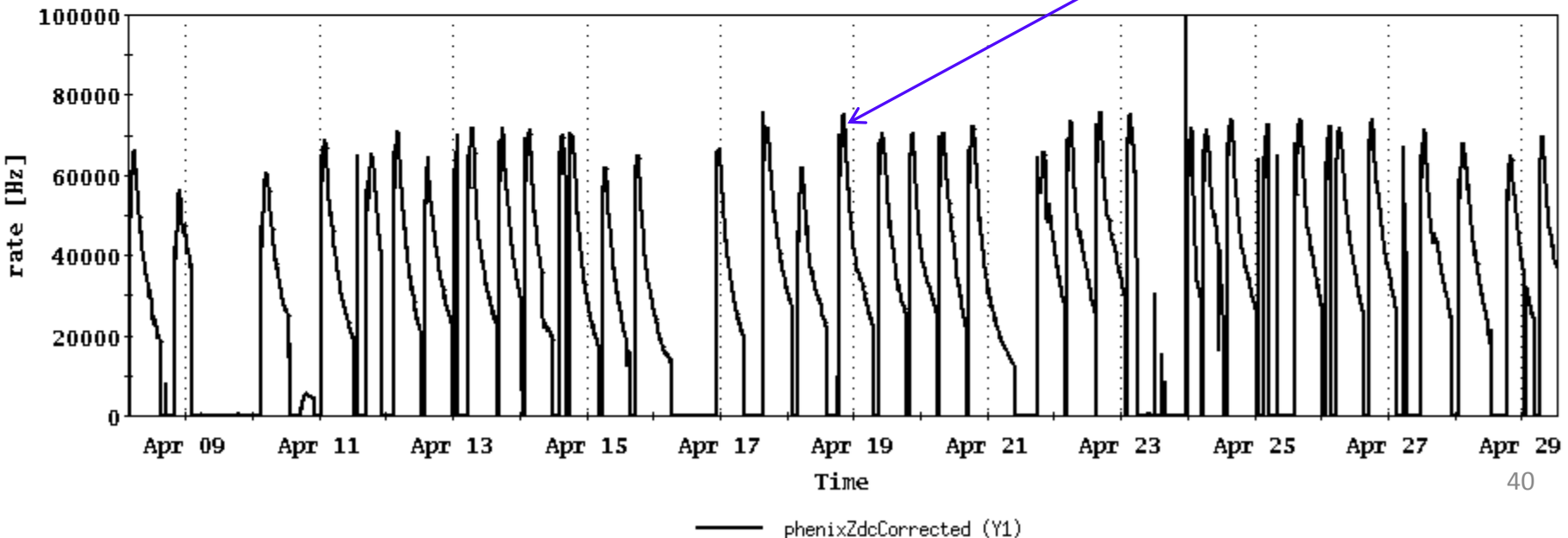
RHIC-II



File Window Markers Analysis

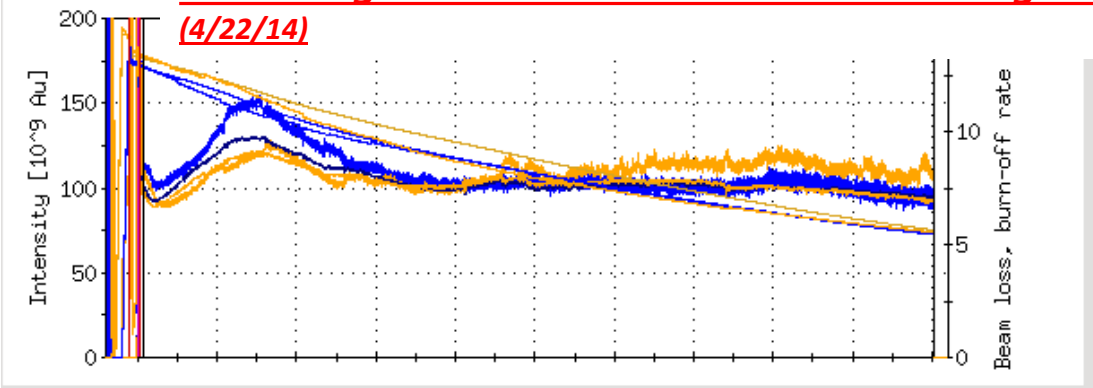


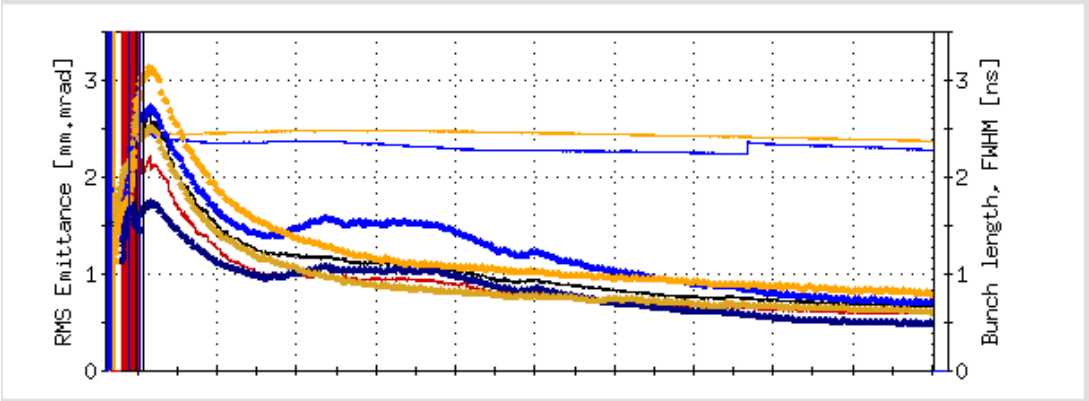
Still ~best ~10 (12) hr store

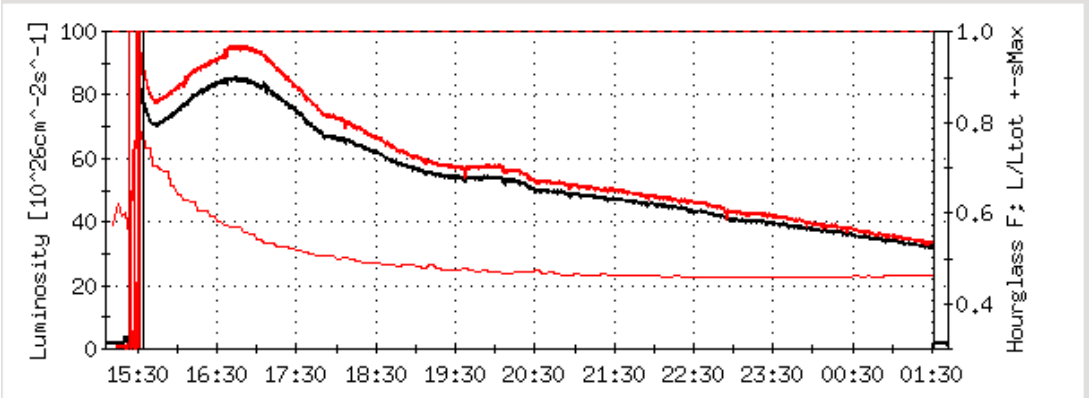


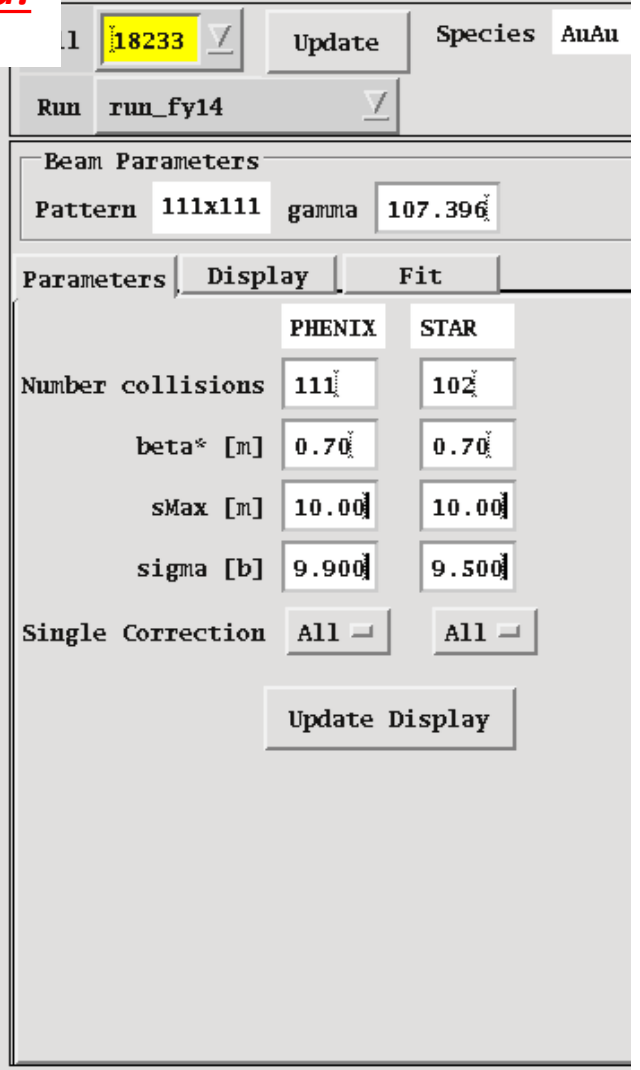
Another good store – a lot more about as good!

(4/22/14)

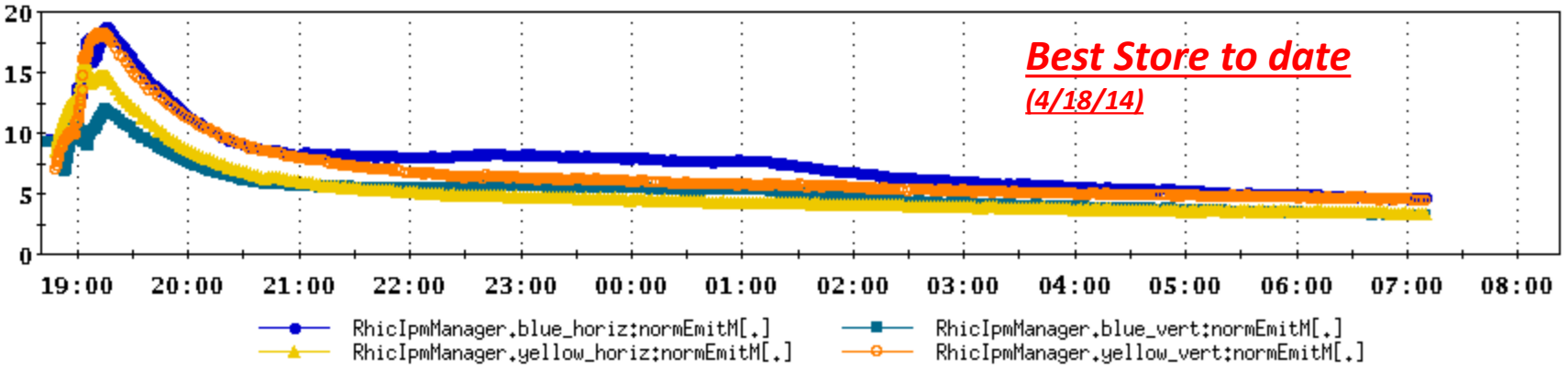


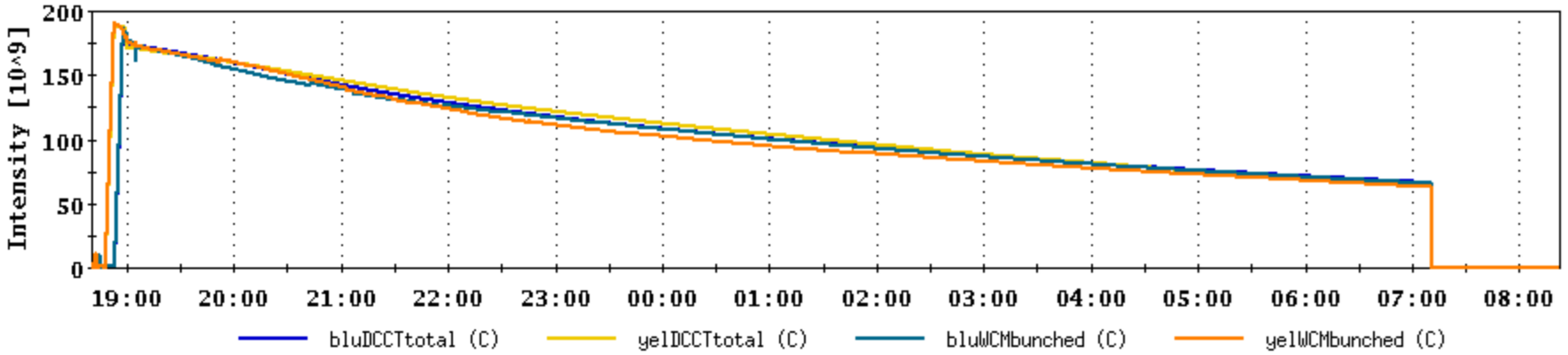


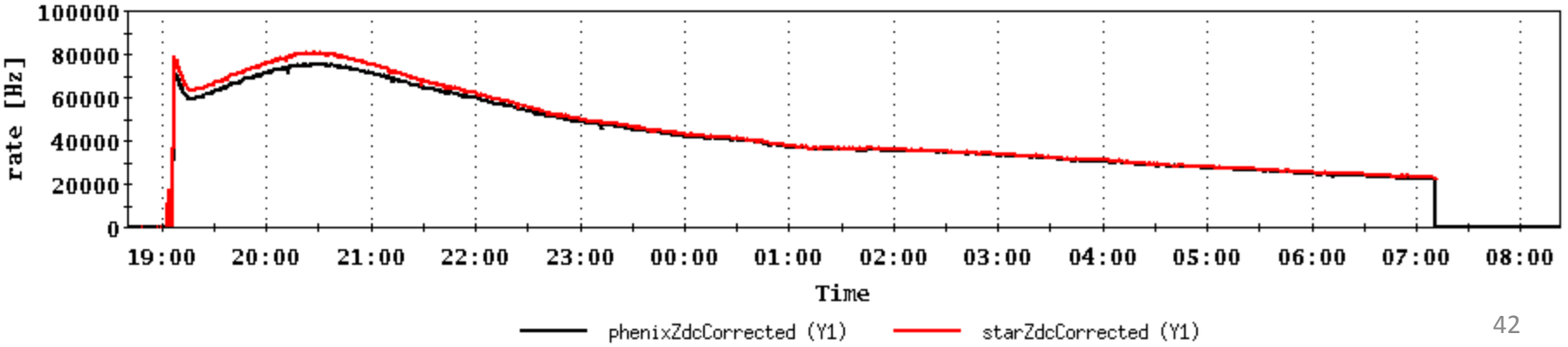





```
Tue Apr 29 12:37:22 2014  -- INFO : Phenix Int Lumi = 193339
Tue Apr 29 12:37:22 2014  -- INFO :  Star avg Lumi = 57979
Tue Apr 29 12:37:22 2014  -- INFO :  Star Int Lumi = 208077
```


Best Store to date
(4/18/14)
20
15
10
5
0
19:00
20:00
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
RhicIpmManager.blue_horiz:normEmitM[.]
RhicIpmManager.yellow_horiz:normEmitM[.]
RhicIpmManager.blue_vert:normEmitM[.]
RhicIpmManager.yellow_vert:normEmitM[.]


Intensity [10^9]
200
150
100
50
0
19:00
20:00
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)


rate [Hz]
100000
80000
60000
40000
20000
0
19:00
20:00
21:00
22:00
23:00
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
Time
phenixZdcCorrected (Y1)
starZdcCorrected (Y1)

Goals for Run 14 (based on Beam Use Requests)

*(11 Feb, DRAFT, **to be updated** by experiments)*

PHENIX

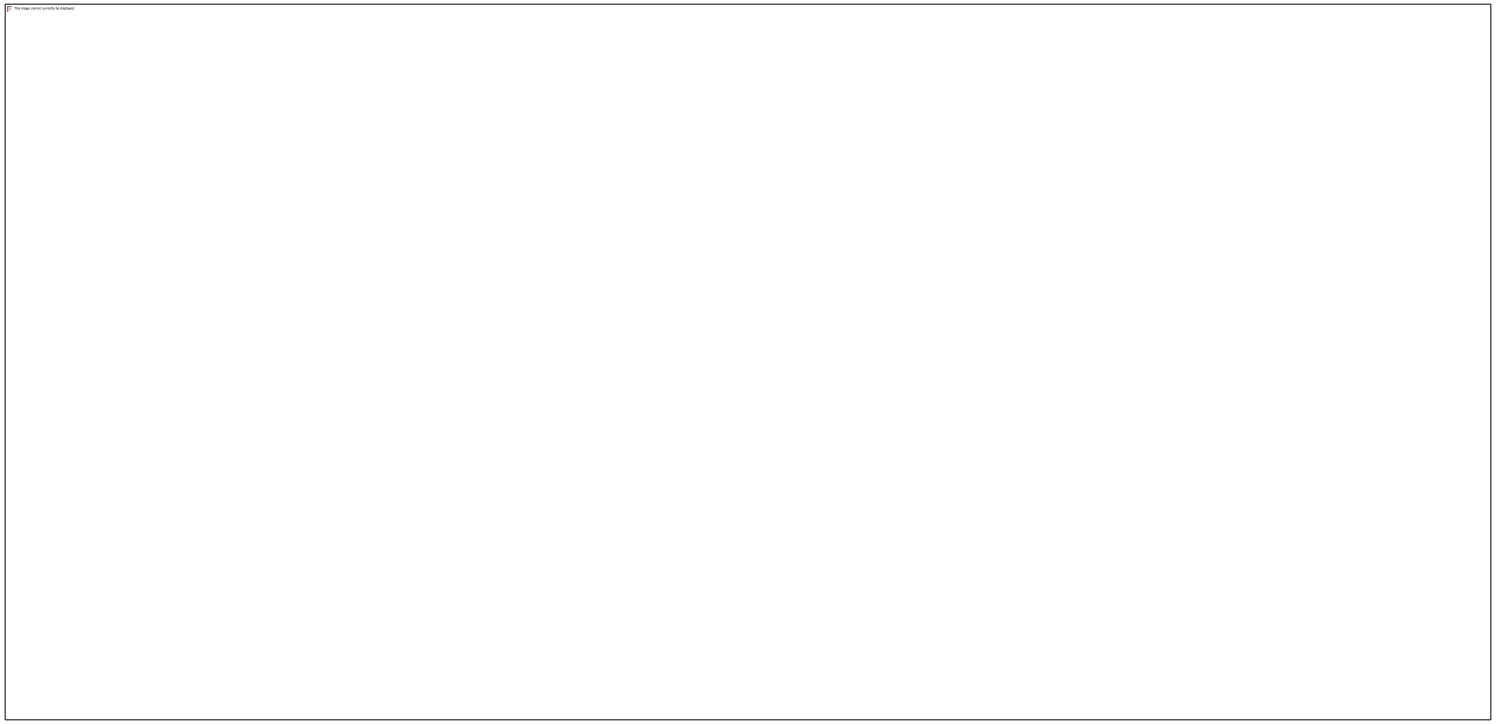
- Au+Au @ 200 GeV for 12 weeks, L = 1.5 nb^{-1} sampled luminosity within |z| < 10 cm]
  - ~30% within |z| < 10 cm]
  - ~90% DAQ efficiency
  - ~50% bandwidth, DAQ saturation factor (?)
  - → 11 nb^{-1} delivered

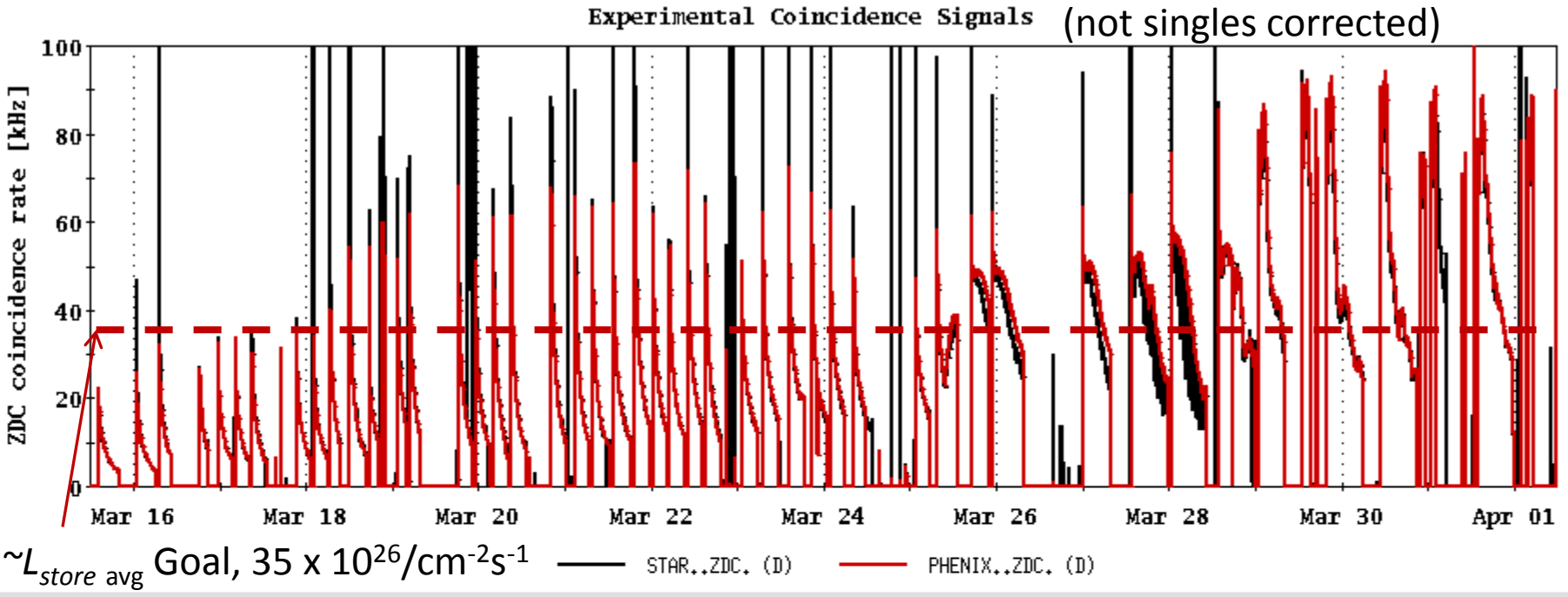
STAR

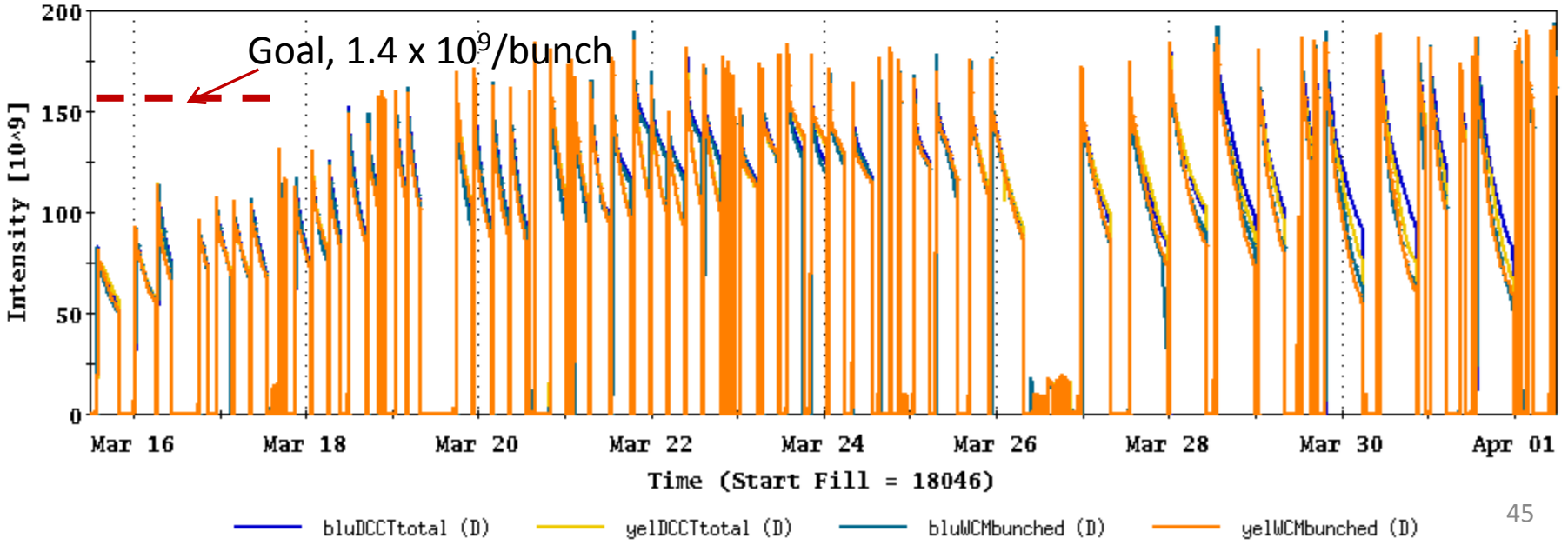
- Au+Au @ 200 GeV for 14 weeks, L= 10 nb^{-1} recorded, 10^9 min bias triggers within |z| < 5 cm] → ($2x10^9$ triggers required)
  - ~ 60% (should be better) sampling efficiency
  - → 16.7 nb^{-1} delivered

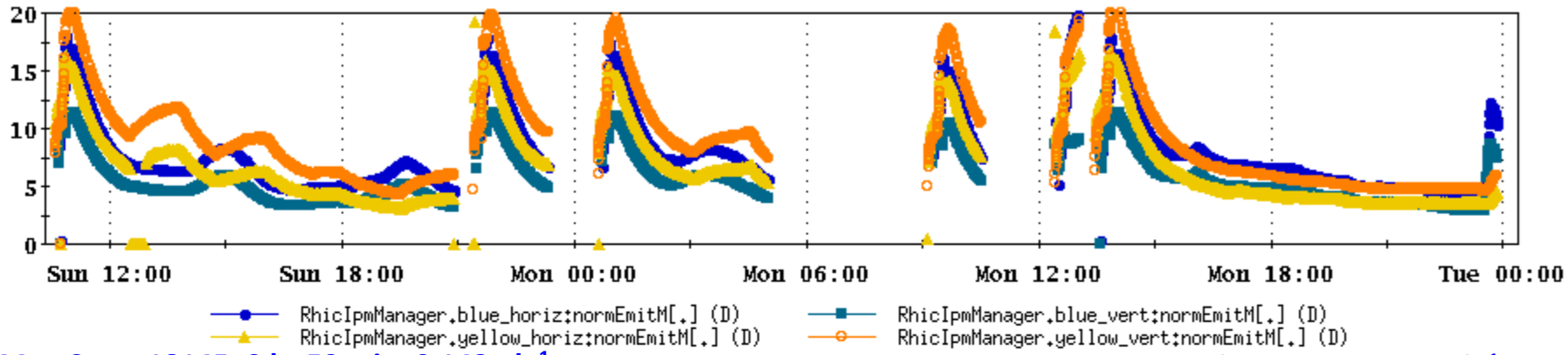
- Au+Au @ 15 GeV for 3 weeks, 150M min bias triggers

4/8/2014 New Electric Rates for this year



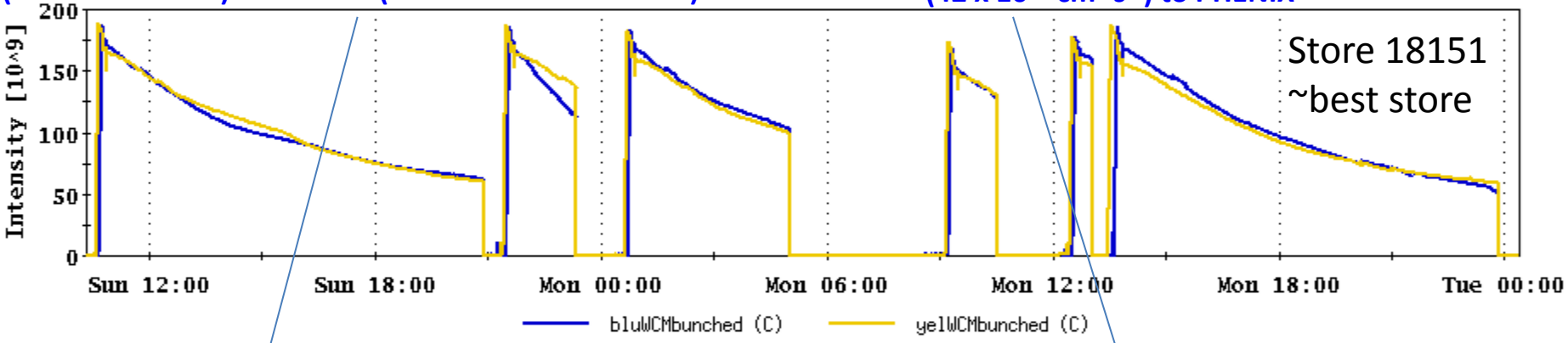

Experimental Coincidence Signals
(not singles corrected)
ZDC coincidence rate [kHz]
100
80
60
40
20
0
Mar 16
Mar 18
Mar 20
Mar 22
Mar 24
Mar 26
Mar 28
Mar 30
Apr 01
~L_{store} avg Goal, 35 x 10^{26}/cm^{-2}s^{-1}
STAR..ZDC. (D)
PHENIX..ZDC. (D)

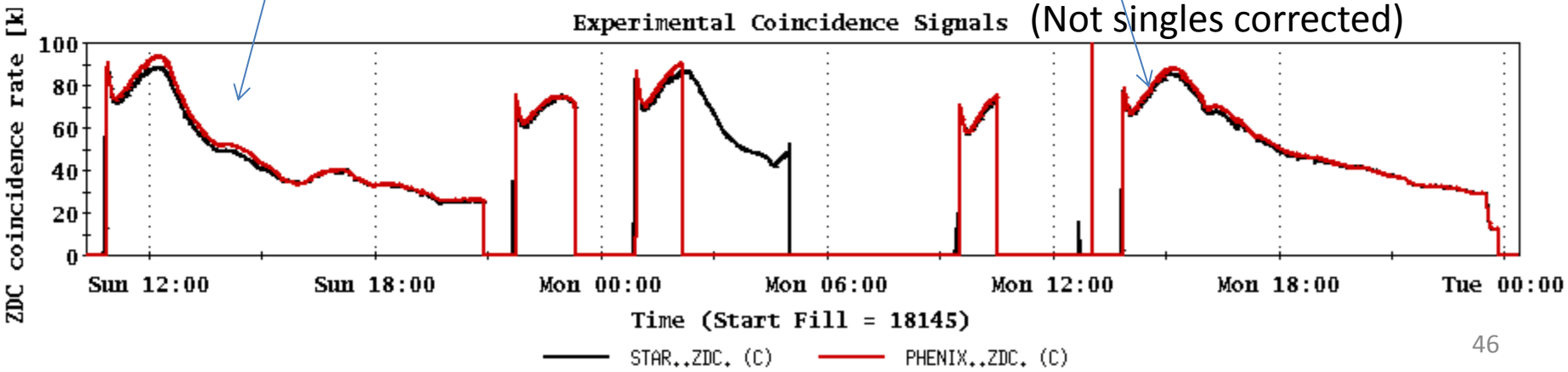

Goal, 1.4 x 10^{9}/bunch
Intensity [10^9]
200
150
100
50
0
Mar 16
Mar 18
Mar 20
Mar 22
Mar 24
Mar 26
Mar 28
Mar 30
Apr 01
Time (Start Fill = 18046)
bluDCCTtotal (D)
yelDCCTtotal (D)
bluWCMbunched (D)
yelWCMbunched (D)



30 Mar, Store 18145, 9 hr 59 min, 0.143 nb^{-1}
(40 x 10^{26} $cm^{-2}s^{-1}$) to PHENIX (assumes 9.5 b xscetion)

31 Mar, Store 18151, 9 hr 49 min, 0.149 nb^{-1}
(42 x 10^{26} $cm^{-2}s^{-1}$) to PHENIX

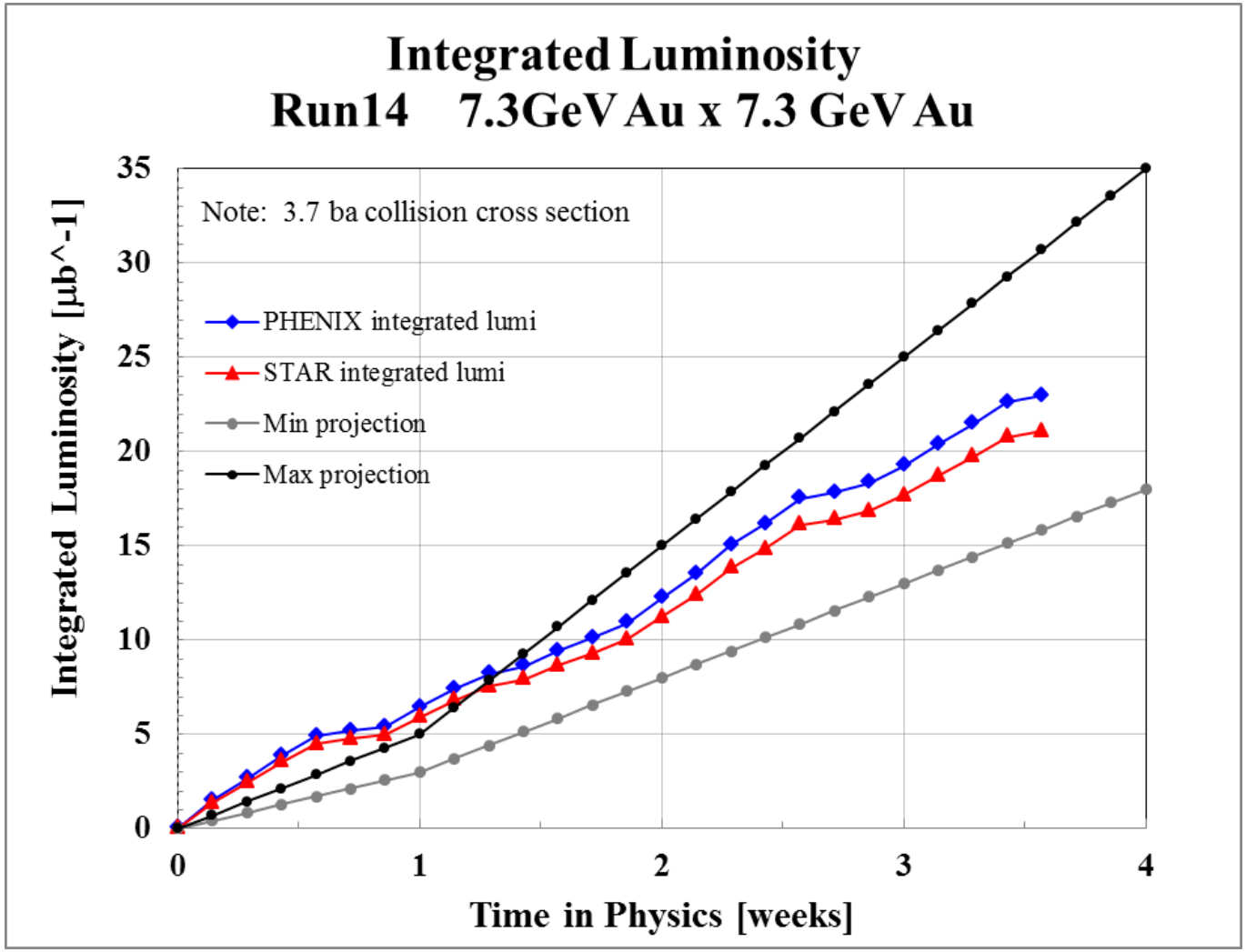




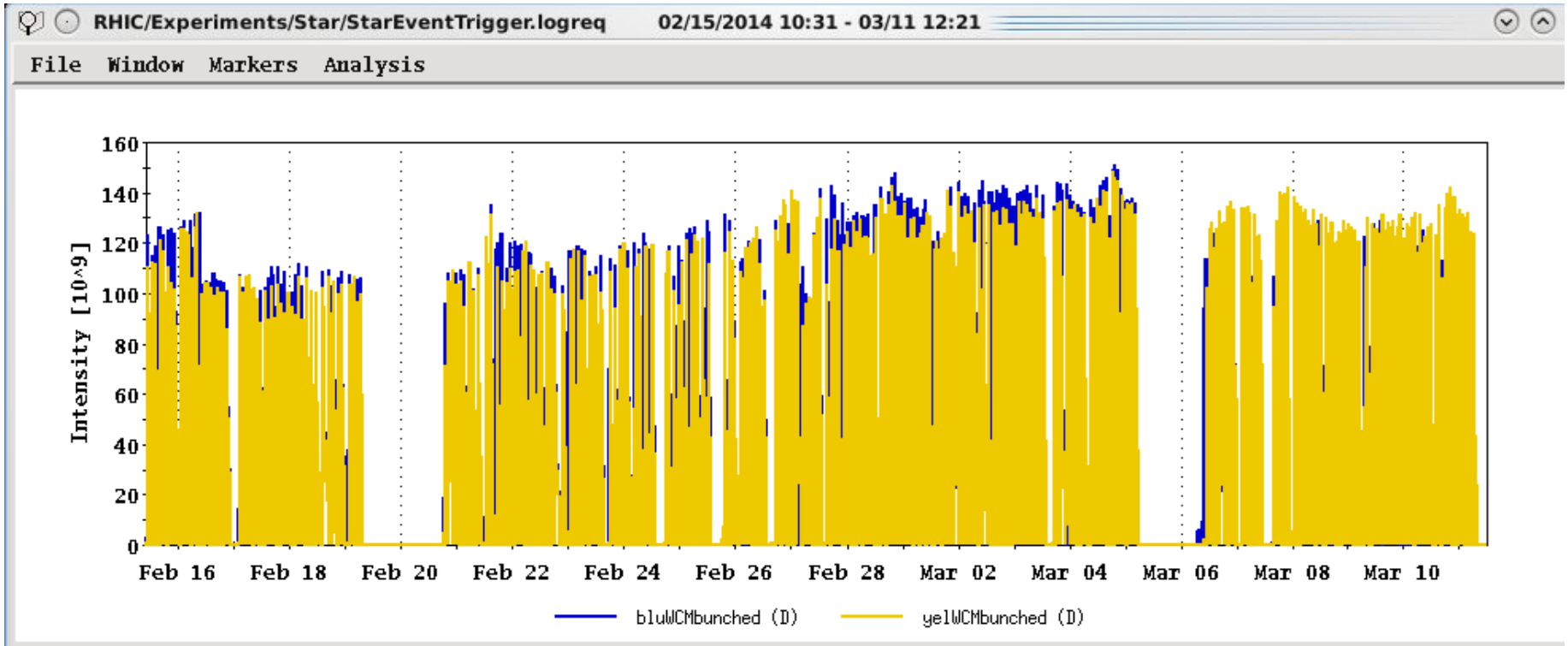
(Not singles corrected)

Through final fill 18010, 11 Mar 2015

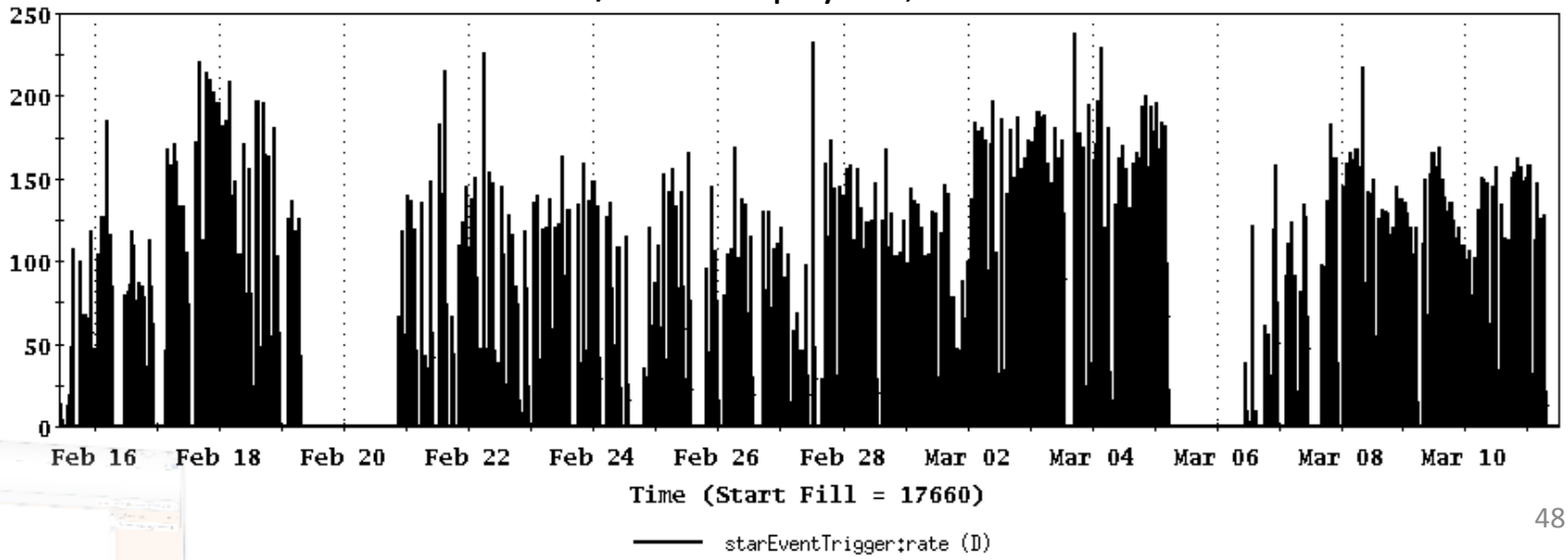
max/min projections from Fischer et.al. “RHIC Collider Projections (FY2014-FY2018)”, 4 June 2013

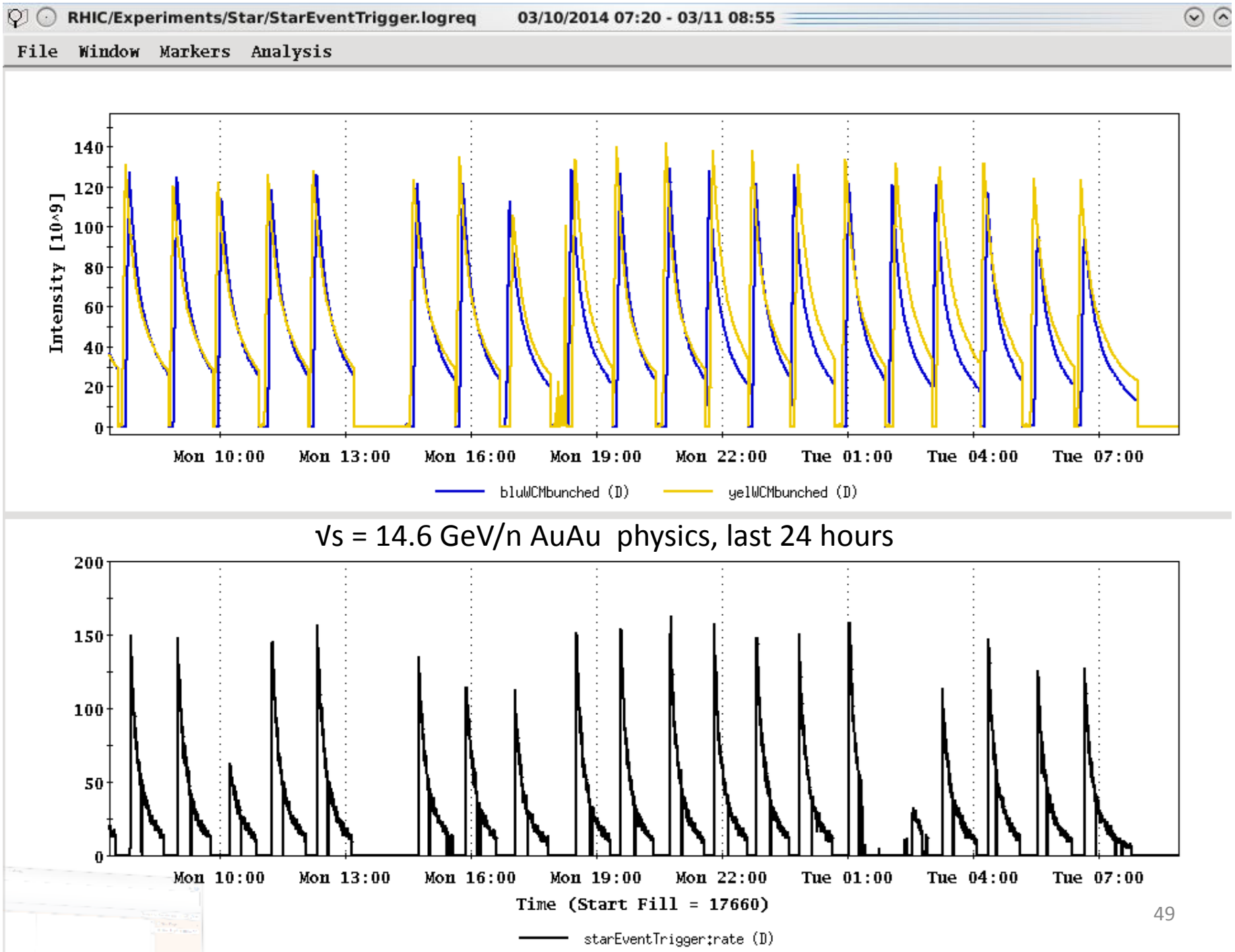


From Ingrassia,
http://www.cadops.bnl.gov/AGS/Operations/Run14/



√s = 14.6 GeV/n AuAu physics, 15 Feb-11 Mar




RHIC/Experiments/Star/StarEventTrigger.logreq
03/10/2014 07:20 - 03/11 08:55
File Window Markers Analysis
Intensity [10^9]
140
120
100
80
60
40
20
0
Mon 10:00
Mon 13:00
Mon 16:00
Mon 19:00
Mon 22:00
Tue 01:00
Tue 04:00
Tue 07:00
bluWCMbunched (D)
yelWCMbunched (D)
√s = 14.6 GeV/n AuAu physics, last 24 hours
200
150
100
50
0
Mon 10:00
Mon 13:00
Mon 16:00
Mon 19:00
Mon 22:00
Tue 01:00
Tue 04:00
Tue 07:00
Time (Start Fill = 17660)
starEventTrigger:rate (D)

http://www.bnl.gov/cad/esfd

Scheduling Physicist: Chuyu Liu

C-A Operations-FY14

4 Mar 14

planned, budget permitting

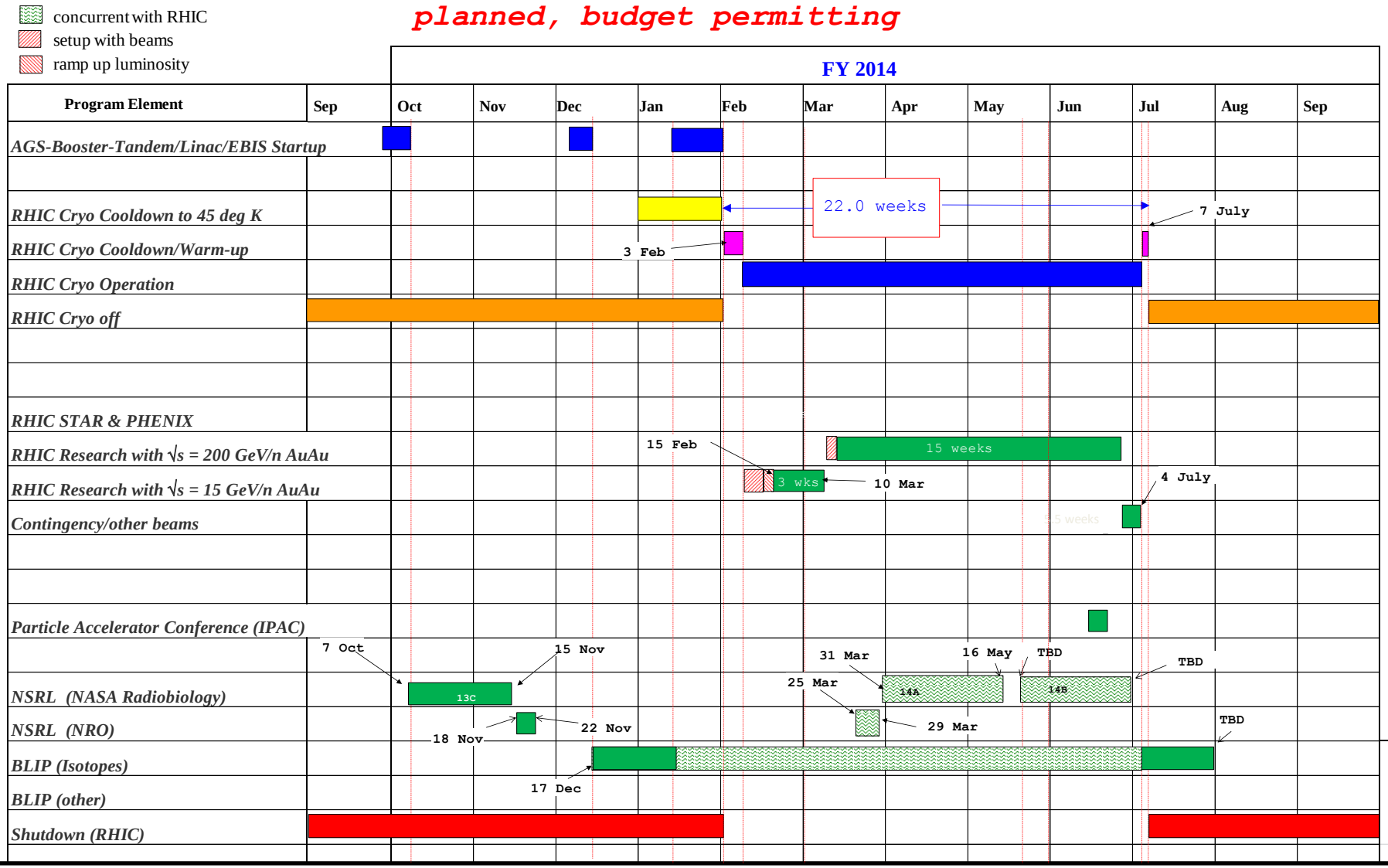


Table 2: Maximum luminosities that can be reached after a sufficiently long running period. The beam energy is stated. Other ion combinations can be estimated on demand. For species combinations not yet run the minimum luminosities are approximately 50% of the maximum.

Mode	Beam energy [GeV/n]	No of colliding bunches	Ions/bunch [10^9]	β^* [m]	Emittance [mm]	L_{peak} [$cm^{-2}s^{-1}$]	$L_{store\ avg}$ [$cm^{-2}s^{-1}$]	L_{week}
Pb-Pb	98.3	111	1.1	0.7	23→8	20×10^{26}	17×10^{26}	0.6 nb^{-1}
Au-Au	100	111	1.4	0.7	23→8	40×10^{26}	35×10^{26}	1.2 nb^{-1}
h-Au ★	100	111	20 / 1.3	0.8	20→23	8×10^{28}	5×10^{28}	16 nb^{-1}
d-Au ★	100	111	110 / 1.4	0.8	17→25	47×10^{28}	28×10^{28}	95 nb^{-1}
p↑-C	100	111	180 / 20	0.8	18→23	10×10^{32}	7×10^{32}	2.3 pb^{-1}
p↑-Cu	100	111	180 / 4.0	0.8	18→23	200×10^{28}	150×10^{28}	475 nb^{-1}
p↑-Au	100	111	180 / 1.4	0.8	18→23	70×10^{28}	50×10^{28}	165 nb^{-1}
p↑-p↑*	100	107	160	0.85	17→25	65×10^{30}	38×10^{30}	14 pb^{-1}
p↑-p↑*	255	107	200	0.65	20→25	280×10^{30}	170×10^{30}	56 pb^{-1}

★ h (helion) – nucleus of the ^{3}He atom; d (deuteron) – nucleus of the ^{2}H atom; p (proton) – nucleus of the ^{1}H atom.
* We expect that an intensity- and time-averaged store polarization P of up to 65%, as measured by the H jet, can be reached at 100 GeV. At 255 GeV we expect the polarization P to reach up to 57%. In Run-11 PHENIX had 107 and STAR 102 colliding bunches.

Fischer et. al. "RHIC Collider Projections (FY 2014 – FY 2018)", 4 June 2013

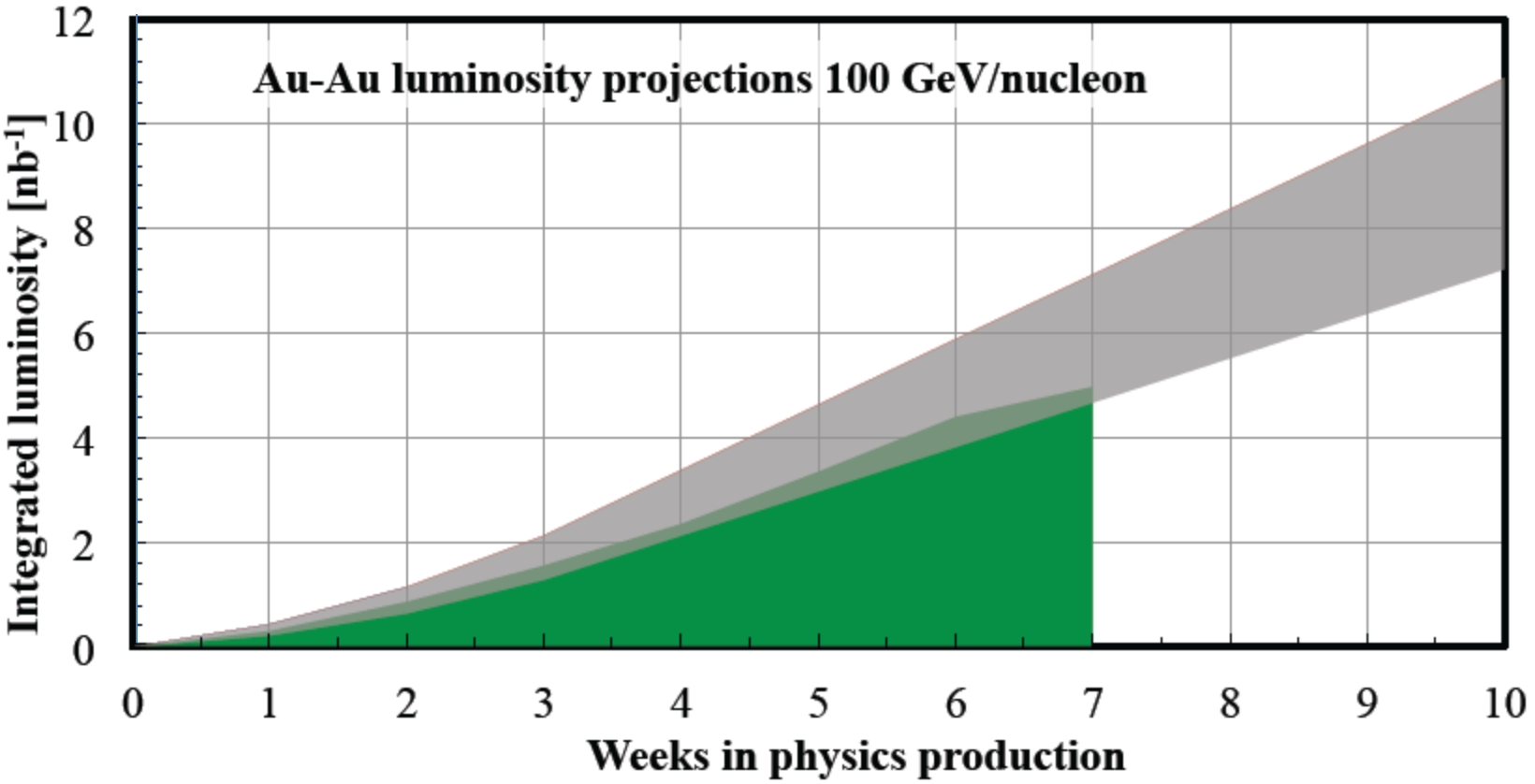
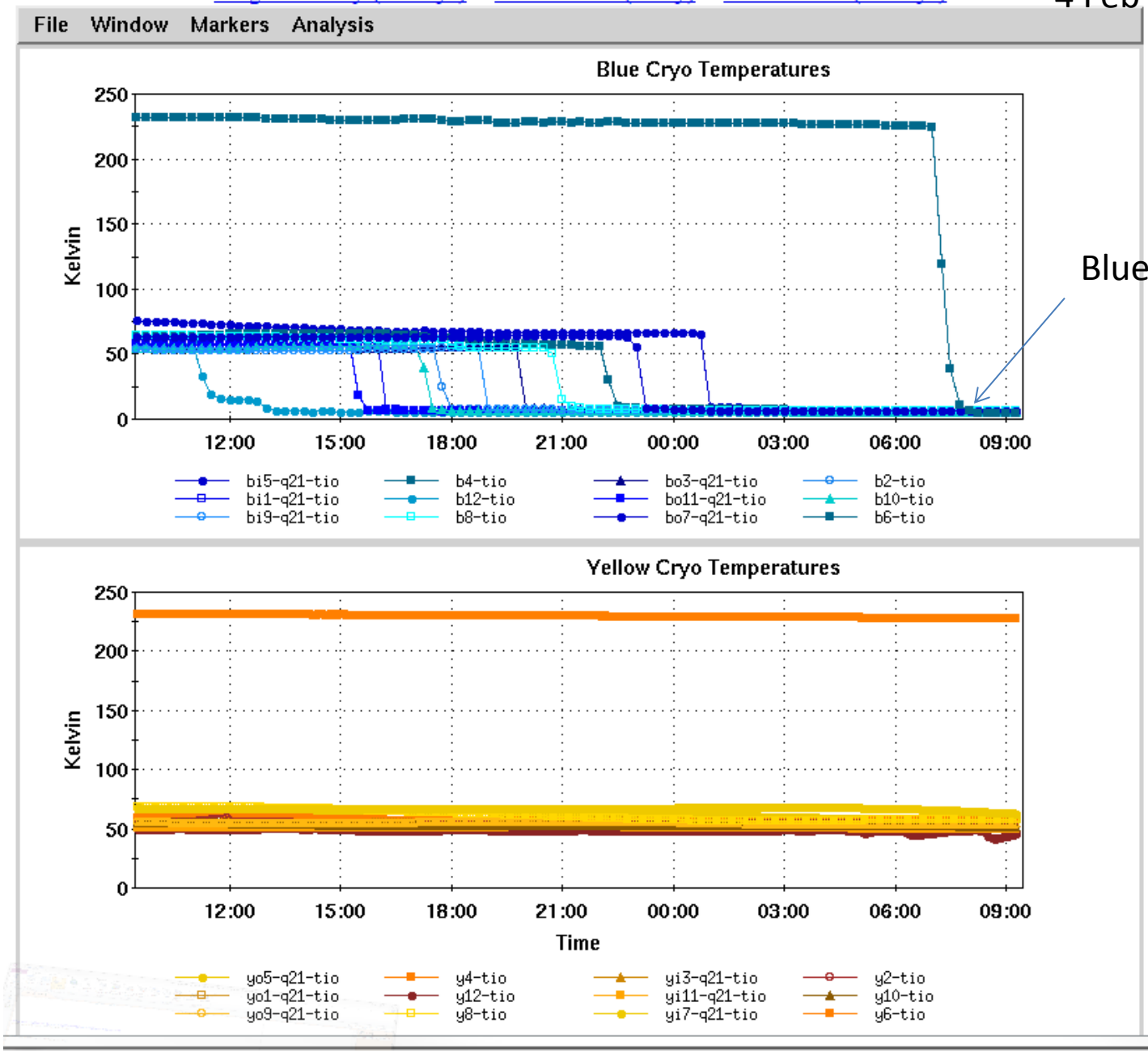


Figure 4: Projected minimum and maximum integrated luminosities for Au-Au at 100 GeV/nucleon.

Fischer et. Al. "RHIC Collider Projections (FY 2014 – FY 2018)", 4 June 2013

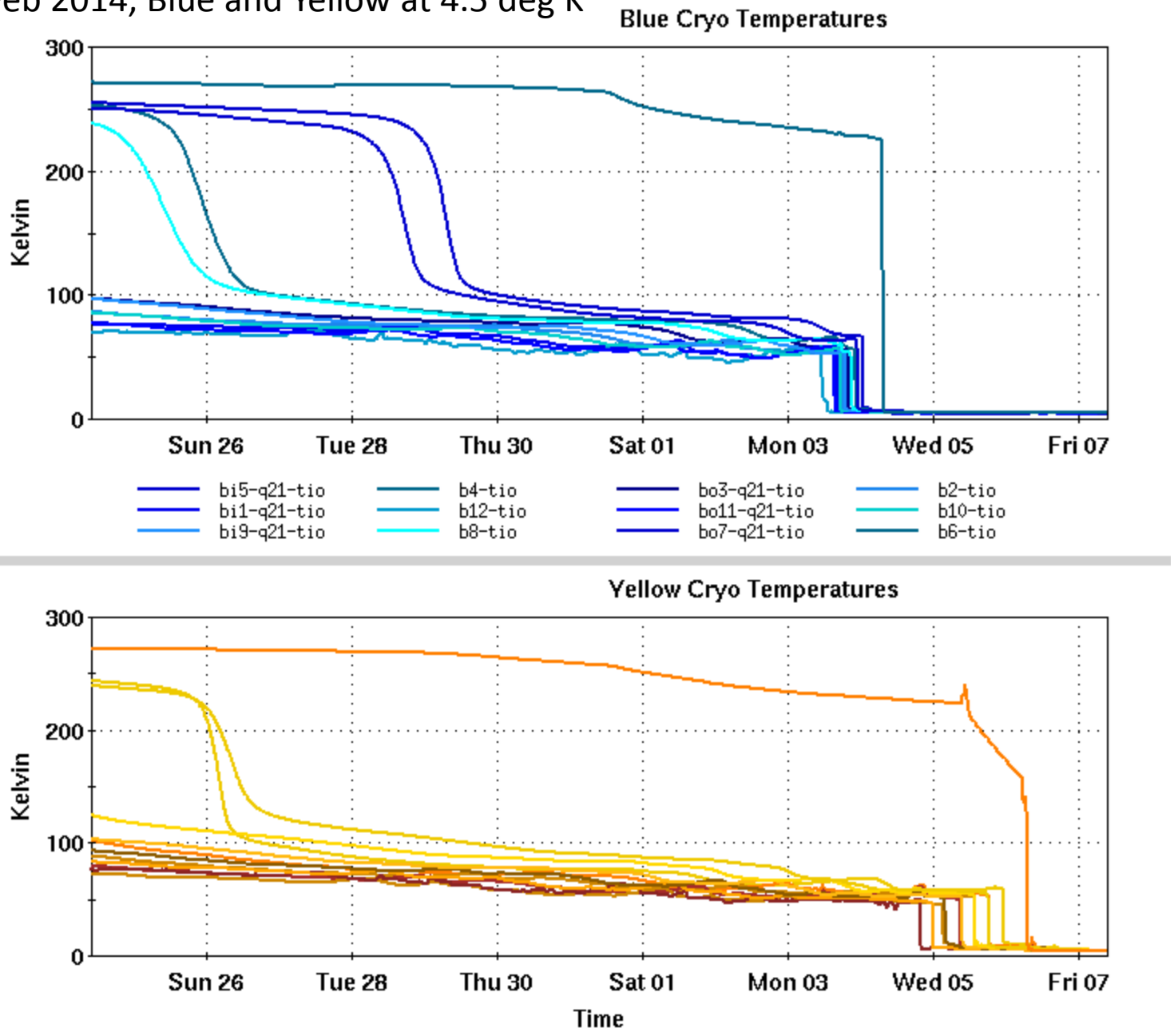
Ring Summary (14 days) Sector Plots (1 day) Sector Plots (14 days)

4 Feb 2014



Blue at 4.5 deg

7 Feb 2014, Blue and Yellow at 4.5 deg K



Who's Who for 2014

RHIC Au-Au Run Coordinator Operations:	**Gregory Marr**	**gmarr@bnl.gov**	**631-344-7810 (office)**
	Vincent Schoefer	**schoefer@bnl.gov**	**631-344-8453 (office)**
	Travis Shrey	**shrey@bnl.gov**	**631-344-7451 (office)**
RHIC 7.3 GeV Au-Au Run Coordinator planning:	**Christoph Montag**	**montagc@bnl.gov**	**631-344-4820 (office)**
RHIC 100 GeV Au-Au Run Coordinator planning:	**Guillaume Robert-Demolaize**	**grd@bnl.gov**	**631-344-8215 (office)**
Scheduling Physicist:	**Chuyu Liu**	**cliu1@bnl.gov**	**631-344-4431 (office)**
AGS liaison:	**Haixin Huang**	**huanghai@bnl.gov**	**631-344-5446 (office)**

For example, 20 weeks of RHIC refrigerator operation in FY 2014 could be scheduled in the following way:

Cool-down from 50 K to 4 K	1 week	
Set-up mode 1 (Au-Au at 7.5 GeV/nucleon)	1 week	(no dedicated time for experiments)
Ramp-up mode 1	½ weeks	(8 h/night for experiments)
Data taking mode 1	2 ½ weeks	
Set-up mode 2 (Au-Au at 100 GeV/nucleon)	½ week	(no dedicated time for experiments)
Data taking mode 2 with further ramp-up	10 weeks	
Set-up mode 3 (p↑-p↑ at 100 GeV)	1 week	(no dedicated time for experiments)
Ramp-up mode 3	½ weeks	(8 h/night for experiments)
Data taking mode 3+1 with further ramp-up	2 ½ weeks	
Warm-up	½ week	

From Fischer et. al., RHIC Collider Projections (FY 2014 – FY 2018), 4 June 2013